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THIRD SERIES FOUNDED BY EDWARD JACKSON

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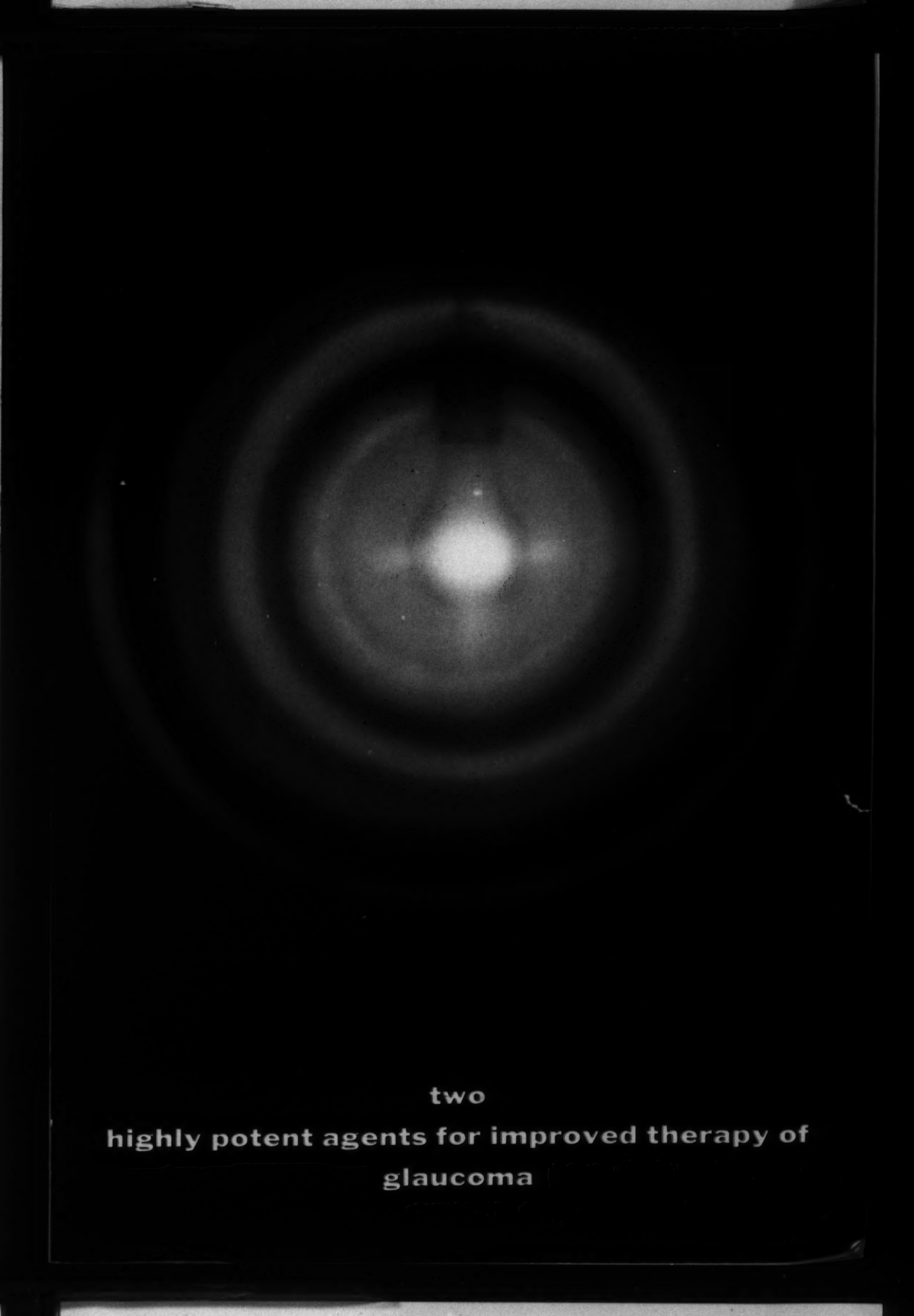
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glaucoma

oral control of intraocular pressure—even on long-term use

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- fast acting
- 50 mg. tablets

topical control of intraocular pressure

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- because it is unusually potent, it may be uniquely useful in breaking up peripheral synechiae
- aqueous—isotonic with conjunctival fluid
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- can be used in combination with DARANIDE
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also available: **FLOROPRYL®** *for local treatment of glaucoma and strabismus*

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0.1% solution, 0.025% ointment

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*HUMORSOL, DARANIDE, AND FLOROPRYL ARE TRADEMARKS OF MERCK & CO., INC.

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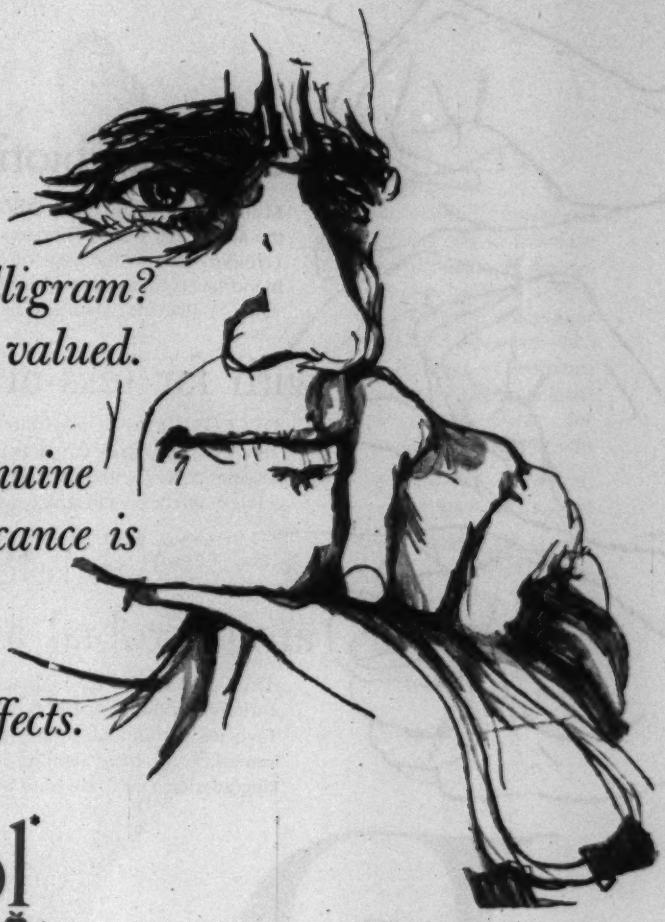

CRITERIA

Tablet size?
Potency per milligram?
Often these are valued.
But the only
criterion of genuine
clinical significance is
the ratio of
desired effects
to undesired effects.
Hence...

Medrol*

the corticosteroid that hits the disease, but spares the patient

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*TRADEMARK, REG. U. S. PAT. OFF. — METHYLPREDNISOLONE, UPJOHN

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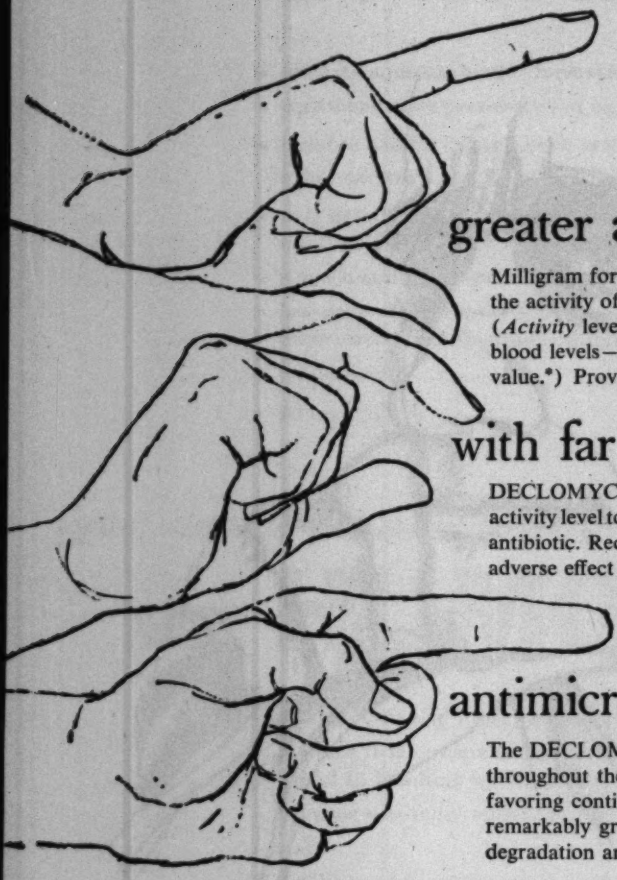
a masterpiece



greater antibiotic activity

Milligram for Milligram, DECLOMYCIN exhibits 2 to 4 times the activity of tetracycline against susceptible organisms. (*Activity* level is the basis of comparison—not quantitative blood levels—since action upon pathogens is the ultimate value.*) Provides significantly higher serum activity level . . ,

with far less antibiotic intake

DECLOMYCIN demonstrates the highest ratio of prolonged activity level to daily milligram intake of any known broad-spectrum antibiotic. Reduction of antibiotic intake reduces likelihood of adverse effect on intestinal mucosa or interaction with contents.

unrelenting peak antimicrobial attack

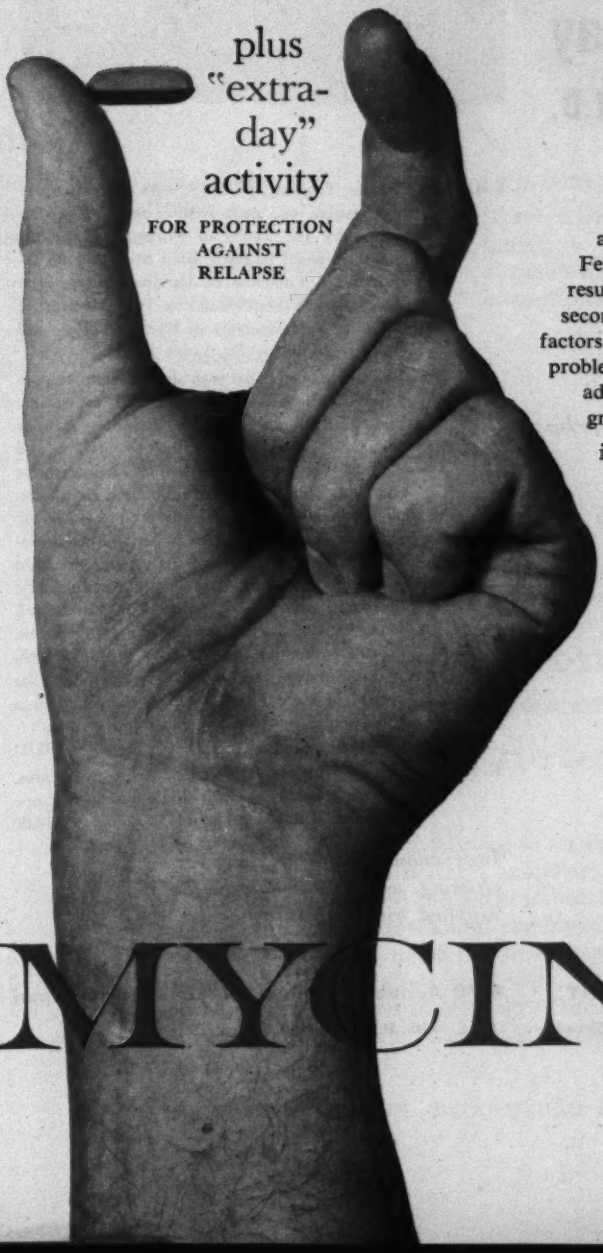
The DECLOMYCIN high activity level is uniquely constant throughout therapy. Eliminates peak-and-valley fluctuation, favoring continuous suppression. Achieved through remarkably greater stability in body fluids, resistance to degradation and a low rate of renal clearance.

*Hirsch, H. A., and Finland, M.: *New England J. Med.* 260:1099 (May 28) 1959.

DECLO

Demethylchlortetracycline Lederle

# of antibiotic design



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Adult dosage: 1 capsule
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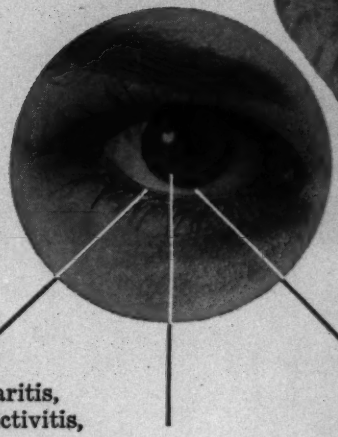

common "outer eye" disorders

allergic
(allergic blepharitis, allergic conjunctivitis, episcleritis)

inflammatory
(acute catarrhal conjunctivitis, ulceration, meibomitis, keratitis)

traumatic
(foreign bodies, burns, abrasions, lacerations)

consistently respond to topical therapy with

METIMYD®

ophthalmic suspension

prednisolone 0.5% plus sulfacetamide sodium 10%

ointment with neomycin 0.25%

Tissue destruction is halted, healing is set in motion by the anti-inflammatory, antiallergic action of prednisolone and the antimicrobial property of sulfacetamide sodium combined in METIMYD Suspension...and for an even wider spectrum of antibacterial effectiveness, neomycin sulfate is added in METIMYD Ointment, the ointment form assuring sustained therapeutic action through the night.

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- optimal not minimal steroid concentration in true solution for peak effectiveness . . . maximal contact at the site of the lesion
- quick-acting broad antimicrobial activity when infection threatens recovery
- superior patient comfort—no stinging, no irritating particles, bland carrier

1. Gordon, D. M.: Scientific Exhibit, American Medical Association, Annual Meeting, San Francisco, 1958.

4 days after treatment ACTUAL CLINICAL PHOTOGRAPHS

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NeoDecadron*

DEXAMETHASONE 21-PHOSPHATE—NEOMYCIN SULFATE

INDICATIONS: Trauma—mechanical, chemical or thermal; conjunctival, corneal, or uveal tract inflammation involving the anterior segment; allergy; blepharitis.

DOSAGE: NeoDECADRON Ophthalmic Solution (0.1%)—One drop 4-6 times daily.
NeoDECADRON Ophthalmic Ointment (0.05%)—Applied 3-4 times daily.

In severe or sight-threatening conditions, the frequency of administration may be increased. Systemic therapy with DECADRON Tablets may be prescribed adjunctively.

PRECAUTION: Steroid therapy should never be employed in the presence of tuberculosis or herpes simplex.

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Product	Steroid Concentration	active ingredients: Dexamethasone 21-Phosphate (as the disodium salt)	active ingredients: Neomycin Sulfate	Supplied
NeoDECADRON Ophthalmic Solution	0.1%	1 mg./cc.	5 mg./cc. (equivalent to 3.5 mg. neomycin base)	5 cc. (⅙ oz.) sterile dropper-bottles
DECADRON Phosphate Ophthalmic Solution	0.1%	1 mg./cc.	—	5 cc. (⅙ oz.) sterile dropper-bottles
NeoDECADRON Ophthalmic Ointment	0.05%	0.5 mg./Gm.	5 mg./Gm. (equivalent to 3.5 mg. neomycin base)	3.5 Gm. (⅛ oz.) tubes
DECADRON Phosphate Ophthalmic Ointment	0.05%	0.5 mg./Gm.	—	3.5 Gm. (⅛ oz.) tubes

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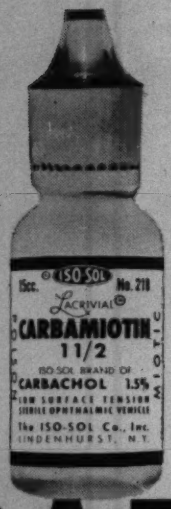

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. . . in chronic non-congestive glaucoma

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CARBACHOL U. S. P.

Iso-Sol brand of sterile, dated, low surface tension solution of Carbamylcholine Chloride with Benzalkonium Chloride 1:10,000 as the wetting agent.

¾% and 1½%

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Acts indirectly by inhibiting cholinesterase and permits natural acetylcholine to act without interference . . . not susceptible to destruction by cholinesterase . . . low allergic index . . . prolonged use will not produce synechia . . . lasts longer — less frequent administration . . .

INDICATIONS

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PACKAGING

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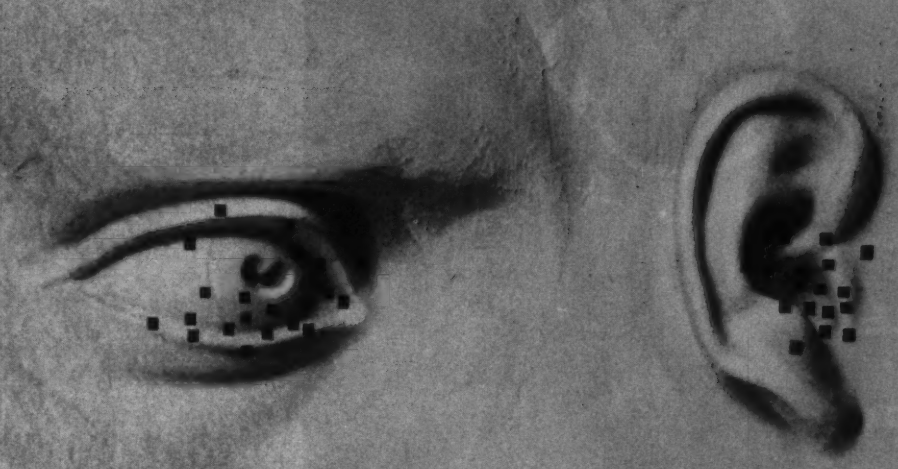

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Neo-Aristocort®

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EYE-EAR OINTMENT

Combining ARISTOCORT acetonide...described as the most effective topical corticosteroid yet introduced*...and the outstanding topical antibiotic, Neomycin.

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NEO-ARISTOCORT EYE-EAR OINTMENT contains: Triamcinolone Acetonide 0.1% and Neomycin Sulphate (0.35% base) 0.5% as the active ingredients; and light liquid petrolatum N.F. 15%, wool fat U.S.P. 10%, and white petrolatum U.S.P. q.s. w/v 100% as the inactive ingredients.

Tubes of ⅛ oz.

Also available:

Aristocort®

Triamcinolone Acetonide 0.1%

Tubes of 5 Gm. and 15 Gm.

CREAM AND OINTMENT

*Baer, R. L., and Witten, V. H.: Editorial Comment. In The Year Book of Dermatology and Syphilology (1958-1959 Year Book Series), Edited by Rudolph L. Baer and Victor H. Witten, Chicago, The Year Book Publishers, 1959, p. 40.

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alpha-chymotrypsin with BALANCED SALT SOLUTION, ALCON

in CATARACT SURGERY

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The BALANCED SALT SOLUTION, ALCON, which is furnished as a diluent and for lavage purposes, is a sterile, physiological balanced salt solution containing those ions essential to normal cellular metabolism. This solution is more acceptable to the intraocular tissues[1]. . . and, in cataract surgery, seems to be more in balance with the normal fluids encountered in the inner eye.[2]

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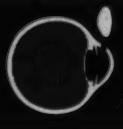
ZOLYSE is safe with no known contraindications in patients over 20.

Each ZOLYSE unit contains one vial of 750 units of lyophilized alpha-chymotrypsin and one 10 cc vial of BALANCED SALT SOLUTION, ALCON, as the diluent and for irrigating the eye.

[1]Girard, L. J., Dukes, C. D., and Fleming, T. C. Presented at the International Congress of Ophth., Brussels, Belgium, 1958.

[2]Kara, Gerald B., "The Use of Alpha-Chymotrypsin in Cataract Extraction," Research Report No. 10, Alcon Laboratories, Inc., 1959.



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AO Tillyer Sets offer you *TRUE* additive effective power

Guesswork or "approximations of power" no longer enter into refractive examinations where AO Tillyer Trial Sets are used. The total correction you obtain may be accurately translated into the Rx spectacle lens required by your patient. The Tillyer additive effective power system compensates for such factors as:

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2. Distance of cylinder lens in front of sphere lens.
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The sturdy, lightweight AO Tillyer Trial rings have a special black finish which prevents annoying reflections. The rings will fit all Trial Frames having 1½" diameter cells.

You may choose between two sets . . . Junior or Senior . . . in new office style cases with removable trays.

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Dept. X253

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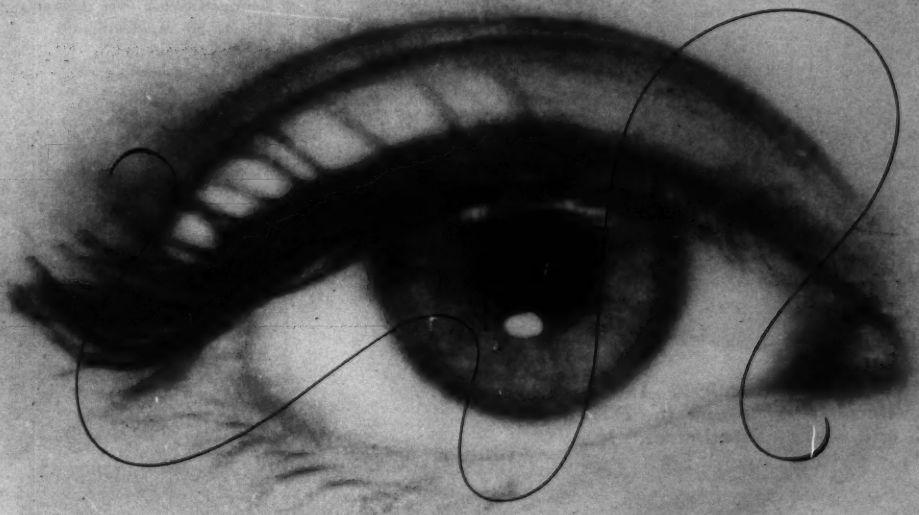

- hand-finished Micro-Point® needles
- unequaled sharpness by hand honing
- 40% greater strength
- increased stability in needle holder
- reduced tendency to cut out of tissue

ETHICON EYE SUTURES with Tru-Tempered reverse cutting needles for maximum strength and minimum tendency to cut out of tissue.

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Eyes Right!

the advantages of oil suspension

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the effectiveness of ACHROMYCIN

rapid suppression of common cocci and bacilli and of susceptible viruses—whether the primary infection or a complication of irritation, trauma, or inflammatory disease . . . fast resolution of swelling, erythema, and lesions . . . excellently tolerated

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Tetracycline Lederle

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new

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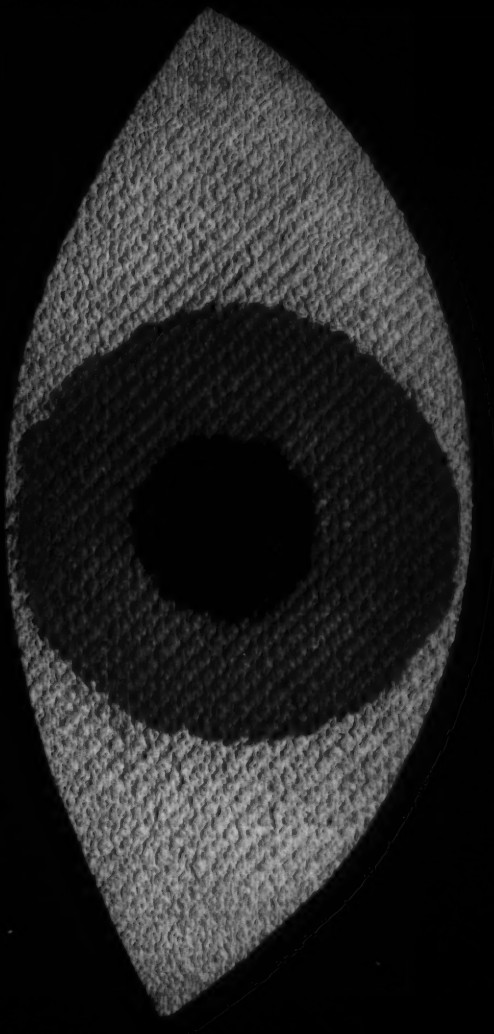
POLYMYXIN B controls resistant strains of gram-negative bacilli. "...gram-negative bacilli are being isolated with increasing frequency from the conjunctiva...."[3] Polymyxin B "...is bactericidal against most gram-negative microorganisms...."[4]

HYDROCORTISONE controls inflammation and allergic reactions. "Cortisone, hydrocortisone and ACTH, by altering the inflammatory responses of the body, cause a decreased amount of scarring and vascularization."[5] "Hydrocortisone is about twice as potent gram for gram as cortisone, even when given locally."[5]

INDICATIONS: Provides wide-spectrum antibacterial, anti-inflammatory, and antiallergic action for topical treatment of patients with ocular inflammation complicated by infection.

ADMINISTRATION: Local application two to four times daily as required.

PACKAGING: OPHTHOCORT Ophthalmic Ointment contains 1% CHLOROMYCETIN® (chloramphenicol, Parke-Davis), 0.5% hydrocortisone acetate, and 5,000 units polymyxin B sulfate per Gm., supplied in ⅛-oz. tubes.



References: (1) Perkins, E. S.: **Practitioner 178**:575, 1957. (2) Queries and Minor Notes, **J.A.M.A. 161**:1032, 1956. (3) Smith, C. H.: **Eye, Ear, Nose & Throat Month. 34**:580, 1955. (4) Blakiston's New Gould Medical Dictionary, ed. 2, New York, McGraw-Hill Book Company, Inc., 1956, p. 945. (5) Ostler, H. B., & Braley, A. E.: **J. Iowa M. Soc. 44**:427, 1954.

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"renders extracapsular lens extraction unnecessary

Alpha
CHYMAR®
alpha chymotrypsin

a new approach to cataract surgery

Simple irrigation of the anterior and posterior chambers with Alpha Chymar loosens the zonule fibers within minutes without injury to any other structure of the eye. Removal of cataracts is thus greatly facilitated. In children, the risks of the needling operation are greatly reduced.

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1. Cogan, J. E. H.: Proc. Roy. Soc. Med. 51:927, 1958. 2. Jenkins, B. H.: J.M.A. Georgia 45:431, 1956. 3. Raiford, M. B.: J.M.A. Georgia 48:163, 1959. 4. Rizzuti, A. B.: A.M.A. Arch. Ophth. 61:135, 1959.

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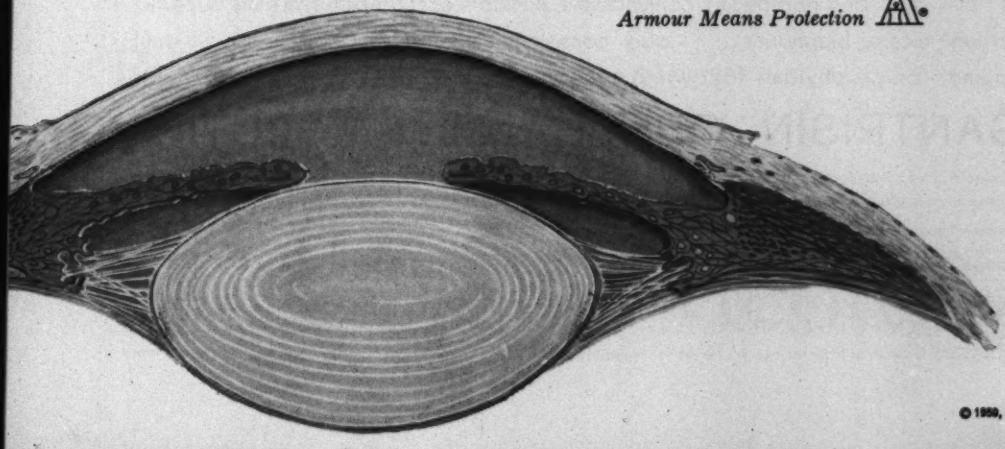

at the pH of tears . . . No stinging or burning since Gantrisin Ophthalmic Solution is isotonic and is buffered at a physiological pH . . . stable and sterile. Antibacterially effective because Gantrisin Ophthalmic contains 4 per cent Gantrisin, the potent anti-infective . . . little likelihood of bacterial resistance. Multipurpose, because Gantrisin Ophthalmic is effective in common external ocular disorders, such as "pink eye" and nonspecific conjunctivitis, punctate and dendritic keratitis, superficial corneal ulcers, blepharitis . . . also consistently effective in many types of ocular trauma, for prophylaxis following surgery and after removal of foreign bodies.

GANTRISIN OPHTHALMIC SOLUTION

Available in 5-cc and ½-oz bottles with dropper.
Also available: Gantrisin Ophthalmic Ointment, in ⅛-oz tubes.

Gantrisin Diethanolamine Ophthalmic Solution and Ointment contain 4% Gantrisin® – brand of sulfisoxazole.
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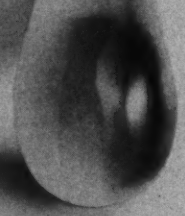

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REFLECTION ON
CORTICOTHERAPY:

The clinical aim, following immediate suppression of disease symptoms, is to maintain the patient symptom-free... with minimal side effects.

The logical course is to select the steroid with the best ratio of desired effects to undesired effects:

the corticosteroid that hits the disease, but spares the patient

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In two-tone Brown, Bronze, Ebony and Gunmetal . . . 44, 46 and 48mm (18 to 26 bridge) . . . 50mm (also 18 to 26) on special order. Shuron Optical Company, Geneva, N.Y., Rochester, N.Y.

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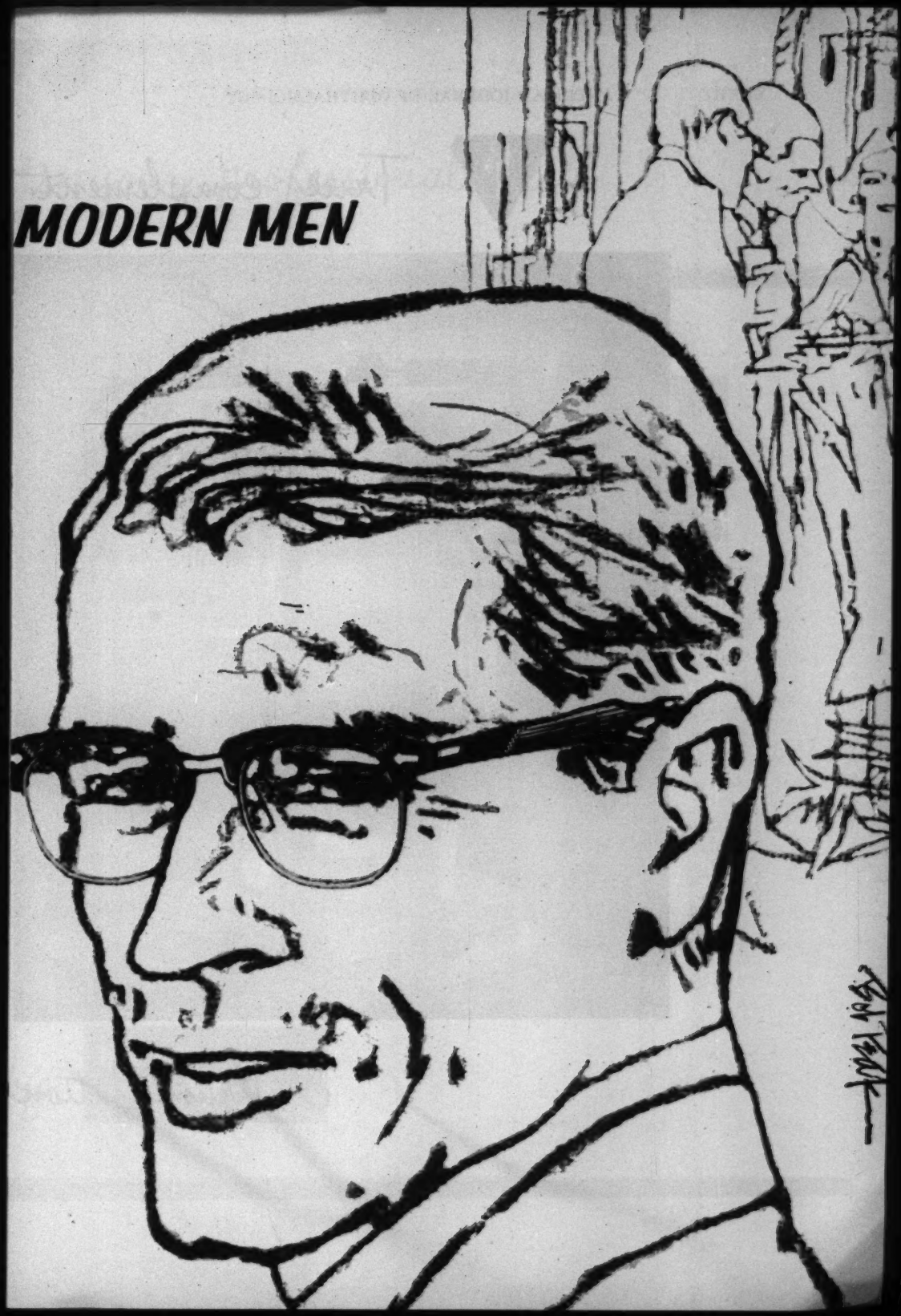
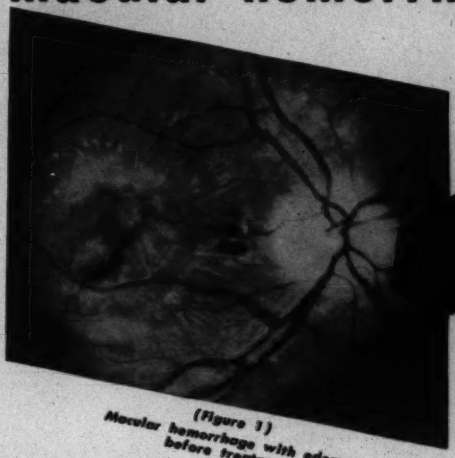

MODERN MEN

macular hemorrhages



(Figure 1)
Macular hemorrhage with edema, before treatment

respond to

IODO-NIACIN

(Figure 2)
After 25 days' treatment with Iodo-Niacin

NO IODISM

Macular and retinal hemorrhages are satisfactorily absorbed after use of IODO-NIACIN[1]. The dosage used in this study was 1 tablet three times daily.

In cases of cerebral and generalized arteriosclerosis, IODO-NIACIN has been used with great benefit[2]. Full doses were given for a year or longer without any iodism or ill effects.

The formula of IODO-NIACIN Tablets contains potassium iodide 135 mg. (2¼ gr.) combined with niacinamide hydroiodide 25 mg. (⅜ gr.). IODO-NIACIN Ampuls 5 cc. are highly satisfactory for intramuscular or intravenous use[3].

Since the retina is intrinsically a part of the brain[4], hemorrhages in this region are indicative of a similar cerebral condition for which IODO-NIACIN is directly indicated.

IODO-NIACIN Tablets, slosol coated pink, are supplied in bottles of 100. Ampuls 5 cc. in boxes of 10.

1. *Am. J. Ophth.* 42:771, 1956.
2. *Am. J. Digest Dis.* 22:5, 1955.
3. *Med. Times* 84:741, 1956.
4. *Cecil's Textbook of Medicine*, 7th ed., 1947, p. 1598.

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STREET _____
CITY _____ STATE _____ ZONE _____

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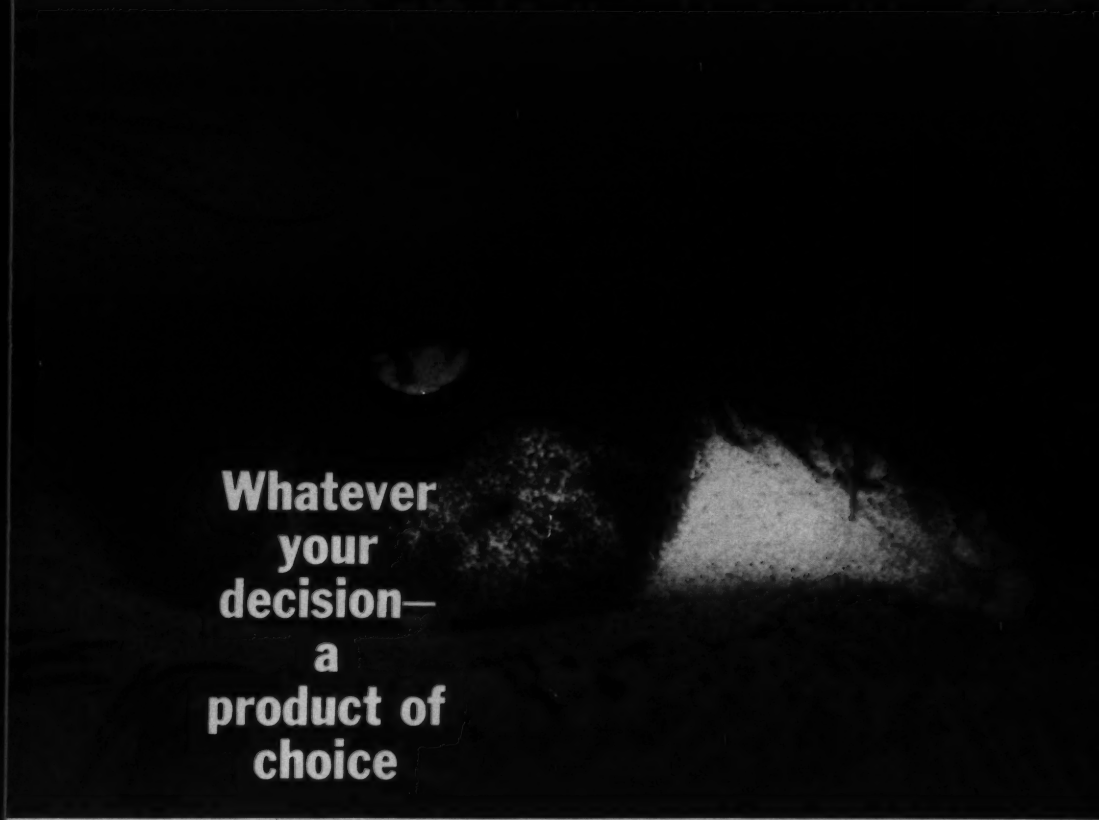

ISOPTO® P-N-P for common, mildly inflammatory, external ocular infections; contains Polymyxin B Sulfate (16,250 units/cc.), Neomycin Sulfate (5 mg./cc.), Phenylephrine HCl (0.12%), and Methylcellulose (0.5%).

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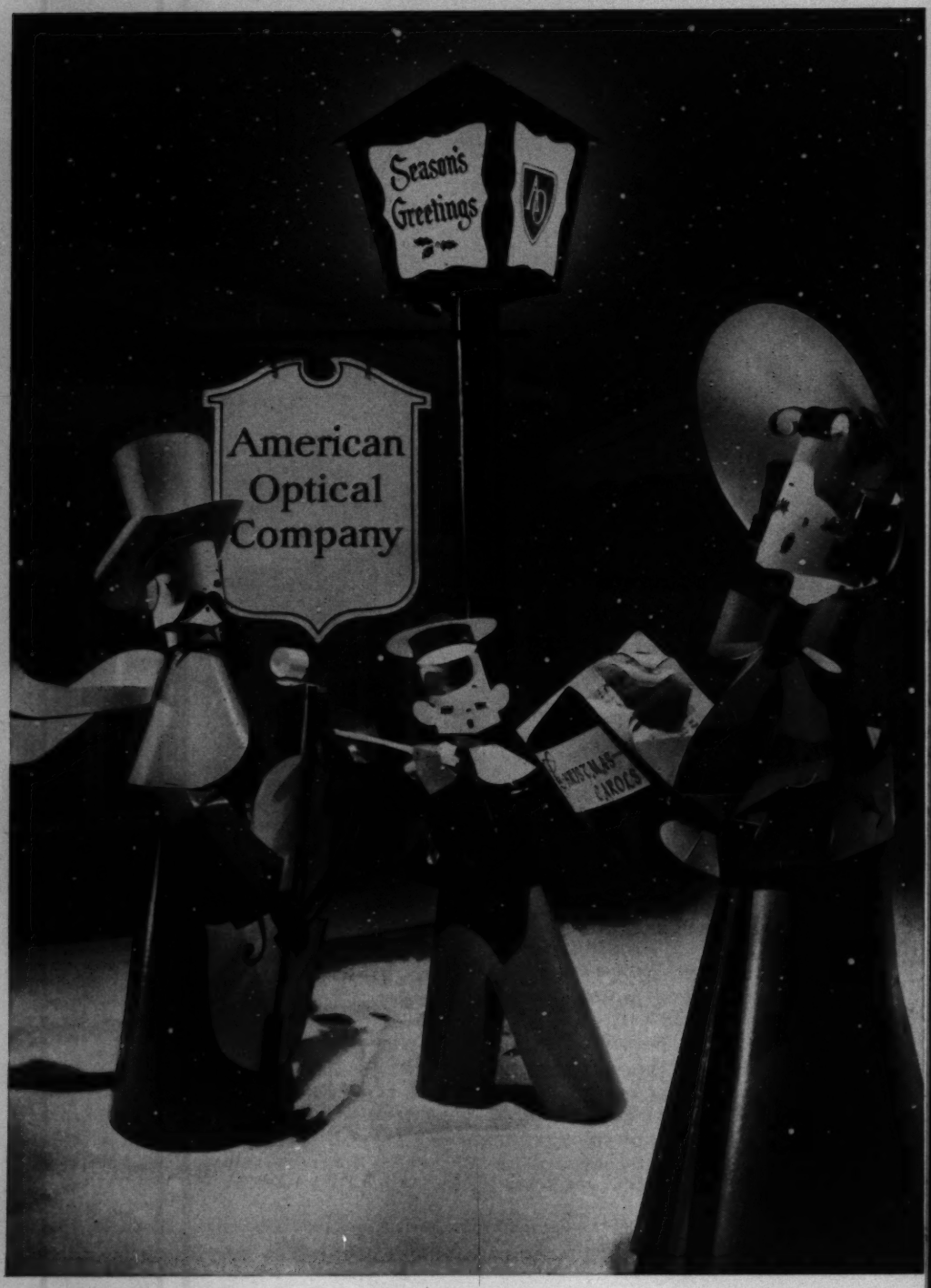
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A SIMPLE Rx ???

The uncomplicated Rx often contains many unseen or unexpected problems. For example, let's look at the following:

R +1.50 + 1.25 × 80 add +2.00 ou
L +1.25 + 1.75 × 140

An analysis of this Rx reveals 1.3 prism diopters of prism base up at the reading point of the right eye and 2.00 PD base up in the left eye—an imbalance of 0.7 prism diopters. While this amount of vertical imbalance is below the 1.0 PD minimum necessary for grinding a balance center, it is certainly more than enough to cause trouble.

What then is the best way to correct this vertical imbalance? Dropping the distance centers 4 mm. would reduce the imbalance at the reading point to 0.35 PD but would create the same amount of imbalance at the distance optical centers. If this is unacceptable, then there are two alternate possibilities—prism segments or dissimilar segments. Prism segments would accomplish the purpose but are somewhat thick. Probably the best way to correct the vertical imbalance would be with the use of dissimilar segments. Flat-top D and flat-top R segments may be used. From the standpoint of maximum optical performance it would be best to use an Ultex A and Ultex E combination—(the Ultex A segment would be used on the left eye).

The 1.75 PD total base out prism at the reading point may be reduced to 1.3 PD by moving the distance optical center in ½ mm. in each eye. This movement should create no problem in the distance portion of the lens. Finally, *additional* decentration of each segment 2½ mm. in beyond the normal reading point will correct 1.0 PD of the base out prism and provide the final necessary step.

It is a good idea to give additional decentration of the segment on all plus lenses up to 10% of the diameter of the bifocal.

If the patient reads a great deal it might be wise to provide a pair of reading glasses with the centers dropped 4 mm. and centered horizontally for the near pupillary distance.

This is an excellent example of the unsuspected problems to be found in an ordinary Rx and the corrective measures which should be taken to insure a comfortable pair of bifocal glasses.

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OCULAR EVALUATION OF THE CEREBRAL PALSIED CHILD

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The ophthalmologist can be of valuable assistance by evaluating vision, ocular motility, and accommodation-convergence problems of the cerebral palsied child, and by offering sound suggestions to aid or overcome any ocular deficiencies. He can make recommendations as to whether the child should be educated as a sighted or blind child.

Fuldner[1] stated: "For the physician who undertakes to assist the progress of the cerebral palsied child, the initial step is a thorough appraisal of the patient in terms of his background and development, and of his sensory, motor, and intellectual assets." The ophthalmologist is called upon to assist by an accurate appraisal of the visual assets and conversely, to determine the liabilities of the visual and neuromuscular apparatus of the eyes to aid in the child's education and rehabilitation.

Visual evaluation is also important for diagnostic reasons. Perlstein and Barnett[2] pointed out the diagnostic importance of interest in reaching for objects, and termed this "grasping with the eyes." The concentration and perseverence displayed in performing test acts may differentiate between poor performance due to motor disability and that due to mental retardation.

Several incidence studies of ocular anomalies found with cerebral palsy have appeared in the literature. Carlson and Miller, according to Guibor,[3] found eye defects in over 50 percent of the patients with central nervous system derangements. Guibor,[4] in his series of 142 patients, showed that 75 percent had motor defects, and 25 percent had subnormal vision. Esotropia occurred in 51 percent, and the most frequent combination was horizontal conjugate deviation with esotropia. Breaky[5] pointed out that 56 percent of cerebral palsied children had associated ocular abnormalities. The greatest number in his series of 100 cases were oculomotor defects. Of this number, 40 percent had esotropia, the most frequently associated abnormality. Schachat[6] reported that 68 percent had ocular defects or refractive errors in his series.

Although the tropias comprise a large percentage of the ocular abnormalities, this is not the major ocular handicap. When submitted in order of educational or physical impedance rather than order of frequency, the following appear to be the ocular abnormalities that hinder most the successful education and rehabilitation of the cerebral palsied child, and to which we must direct our efforts of recognition, evaluation and interpretation:

1. Blindness, bilateral subnormal vision, and high refractive errors of both eyes. This constitutes the greatest handicap, the lack of ability to see.

2. Disturbances of ocular motility and abnormal head postures, which make normal ocular use difficult or impossible in the usual daily tasks.

3. Monocular amblyopia, either through uncorrected high refractive error or through disease processes. This category includes strabismic suppression and amblyopia.

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4. Visual field defects which interfere with central vision, or the normal reading processes.

5. A combination of the defects just listed.

6. Associated congenital or developmental defects.

The ophthalmologist is often called upon to assist the interested physicians and many allied coworkers in the field of cerebral palsy in regard to: (1) Does this child see? How much does he see? What are his visual capabilities in regard to his daily needs and education? (2) What other ocular liabilities are there that may impede his educational rehabilitation? (3) What can be done to overcome or correct these hindrances?

I. Blindness and bilateral subnormal vision

It is important to recognize those patients who may be considered partially sighted but who have useful vision. These patients may be taught by sighted aids, such as the usual sight-saving methods, or by aid of such large-print books as those distributed by the Aid to Visually Handicapped organization of San Francisco. Those patients who are considered to have subnormal but nonuseful vision for teaching by sighted aids must be considered blind and taught Braille, provided they have the tactile and mental faculties.

Due to the frequent lack of subjective intercommunication, visual evaluation calls for fine clinical observation and judgment. The examiner must utilize subtle impressions of the child's alertness: the desire to "grasp with the eyes," ability to grasp for small toys or various sized threads and strings presented unobtrusively. He must look for fixation movements of the eyes upon the finest objects, and other signs. All objective resources must be utilized, such as pupil reflexes, blink reflexes, and opticokinetic reflexes. The possibility of objective vision testing by opticokinetic nystagmus as shown by several authors,[7-9] may be of great assistance in the visual evaluation of the cerebral palsied child.

In evaluating vision it is well to keep in mind the normal for the attained age of development. According to Chavasse,[10] fixation ability stabilizes between three to six months of age, and the most rapid development of vision occurs within the first two years: vision of 6/728 (20/2000) develops into 6/12 (20/60). After the age of two years, vision develops from 20/60 to 6/6 (20/20) in an additional two to three years, and at the age of eight years the visual reflexes should be fixed. The influence of uncorrected errors of refraction in producing amblyopia ex anopsia has been summarized by Duke-Elder.[11] If found at an early age, before full visual development, subnormal vision from this cause may be improved by optical correction. It may be that correlating the visual acuity with the degree of refractive error present (Duke-Elder[11]) will suggest searching for other causes of amblyopia, especially if there is a gross dissociation of vision and refraction.

A. Optic atrophy (total and partial)

Although optic atrophy occurs much less frequently, it is one of the major problems hindering the education of the cerebral palsied child. Breaky[5] listed its incidence as three percent, and Guibor[4] found a two-percent frequency. Schachat[6] stated that it was second in frequency in his series.

Cordes[12] surveyed several schools for the blind and reported that optic atrophy was the cause of blindness in 15 to 34 percent of the pupils. He pointed out the great difficulty of diagnosis of optic atrophy in children and listed his diagnostic criteria as: (1) pallor of the disc, (2) recession of the disc, (3) lowered visual acuity, and (4) field changes. Cordes[12] emphasized that disc pallor alone was not of diagnostic significance because of the great variation in disc color and emphasized that the discs are naturally paler in infants.

Doggart[13] stated that optic pallor was a

cardinal sign but acknowledged the difficulty of evaluating pathologic pallor and noted that partial optic atrophy may remain undiagnosed until subjective tests could be used. Optic atrophy may, however, be suggested by such external signs as nystagmus, impaired pupil reaction, blank stare, proptosis, or squint. Since the defect is permanent and irreversible, the prognosis should be guarded.

CASE 1

(Cerebral palsy; spastic paraplegia; bilateral superior oblique muscle palsy; subnormal vision due to bilateral partial optic atrophy.)

This five and one-half-year-old boy had difficulty in recognizing nonfamiliar objects and held them close to the eyes. He was a three lb. five oz. premature baby with a history of retarded development. He also had a past history of intermittent strabismus and surgery. He heard and spoke normally but intercommunication was difficult, due to intellectual immaturity. Unaided vision was estimated at 20/300 each eye (E test), unimproved with lenses. The eyes were straight in the primary position with no nystagmus. There was a depressed chin posture. Motility study revealed bilateral superior oblique palsy with overaction of the inferior oblique muscles. Cycloplegic retinoscopy revealed a moderate degree of congenital myopia (—6.OD. sph.) and ophthalmoscopic examination showed definite bitemporal optic nerve pallor. The intellectual immaturity and poor vision were factors in his visual perceptual and visuomotor problem. Vision was considered as subnormal, useful, and recommendation was made for teaching as a partially sighted child.

CASE 2

(Postencephalitic quadriplegia; cerebellar ataxia; blindness due to total optic atrophy.)

This nine-year-old girl had a past history of encephalitis. She had a borderline I.Q. Eye examination revealed complete absence of light fixation and absent blink reflexes to hand and light stimuli. There was an alternating divergent strabismus and a fine rotatory nystagmus in the primary position. Both pupils were nonreactive to light. The optic discs were dead white and sharply outlined, indicative of the pathologic pallor of optic atrophy. This child was obviously blind, and it was recommended that Braille teaching be instituted.

CASE 3

(Cerebral palsy; athetoid quadriplegia; subnormal vision due to bilateral partial optic atrophy.)

This 18-year-old boy had a medical history of irregular nystagmus at six months of age, retarded development, and a diagnosis of cerebral palsy at one year of age. He displayed a severe degree of athetoid involvement of the arms, neck, and head, and attempted to maintain stabilization of the head by placing his arms around the neck for steadiness. He had inco-ordinate eye movements of spastic ocular elevation and inability to converge. Visual evaluation was extremely difficult due to lack of intercommunication as a result of a speech defect. Vision of the right eye was grossly subnormal and nonuseful. Corrected vision of the left eye was 5/100 (number chart) for distance and 14/140 (E test) for near. This was equivalent to three-eighths inch or 27-point type. Funduscopy revealed an extreme degree of optic disc pallor bilaterally. The discs were sharply outlined. This patient had subnormal, but useful vision and was considered partially sighted. Magnifying aids were impractical due to the extreme head movements and limited field. This case presented a difficult problem because of the athetoid inco-ordinate head and ocular movements which made ocular fixation almost impossible.

B. RETROLENTAL FIBROPLASIA

Since prematurity plays a part both in retrolental fibroplasia and cerebral palsy, it is not surprising to find a case of this type associated with cerebral palsy.

CASE 4

(Cerebral palsy; spastic quadriplegia; mental retardation; blindness due to retrolental fibroplasia, grade 4.)

This four-year-old boy had a history of prematurity due to placenta praevia and Cesarean section (birth weight two lb., two oz.). The diagnosis of retrolental fibroplasia had already been established. He preferred the head-down, chin-depressed position, with the eyes rotated upward. There were gross aimless wandering movements of both eyes and an apparently involuntary upward ocular rolling motion. This vertical movement was large, with a slow upward and a rapid downward phase. There was a left convergent strabismus of 25 degrees.

The eyes were microphthalmic with corneal diameters of 10 mm. The anterior chambers were flat with mid-dilated nonreactive pupils. White retrolental membranes were noted, bilaterally, occupying the inferior half of the globe. A fundus reflex could be obtained only in the upper portions of the retinas, but no details could be seen. This inferior mass of retinal detachment obscured the optic nerve and macular regions. Blink reflexes were not obtained to sudden hand movements or noxious light stimuli, indicating no visual perception. The upward rolling of the eyes and the chin depression appeared to indicate a vain attempt to utilize the upper peripheral portions of the retinas for light stimuli. This child was blind and educational processes were recommended along these lines.

C. BILATERAL HIGH REFRACTIVE ERRORS

It is not uncommon to find high refractive errors, high myopia and high astigmatism

associated with cerebral palsy. This may seriously interfere with the child's visual assets. Optical correction should be given if the wearing of glasses is feasible.

CASE 5

(Spastic left hemiplegia and convulsive disorder; left homonymous hemianopsia; mild amblyopia ex anopsia secondary to bilateral high mixed astigmatism; exophoria with convergence insufficiency.)

This 18-year-old girl had a history of spastic left hemiplegia, left homonymous hemianopsia and hemisensory disturbance of the left side since the age of five years, at which time she had two neurosurgical operations of the right cerebral hemisphere. She was independently ambulatory with good speech communication. Eye examination revealed an unaided vision of 20/200, each eye, corrected to 20/30 with: R.E., −1.75D. sph. ⌒ + 4.0D. cyl. ax. 85°; L.E., −2.75D. sph. ⌒ + 5.5D. cyl. ax. 100°. Glasses were prescribed. Ocular motility was normal except for an exophoria of 10 prism diopters for distance and 20 prism diopters for near. No limitation of ocular work was advised. Prismatic correction or orthoptics was deferred to such time as necessary should the convergence insufficiency become symptomatic, but was pointed out as a possible future hindrance.

II. HANDICAPPING ABNORMAL HEAD POSTURE AND DISTURBED OCULAR MOTILITY

Involvement of the lower bulbi nuclei subserving speech and deglutition implies possible involvement of the upper bulbar oculomotor nuclei. Thus, speech problems and dysarthria should alert one to study the ocular motility for associated defects. Similarly, facial grimacing or facial palsy may indicate some adjacent oculomotor involvement. Many cases of disturbed ocular motility are found to be associated with facial or speech involvement (Case 6, 7, 8, 10, 12, 14).

A. ABNORMAL HEAD POSTURE (fig. 1)

Abnormal head posture can be a valuable clue to disturbances of ocular motility. Head-tilt is associated with oblique muscle palsies and, to a lesser extent, vertical rectus palsies. Head-turn to right or left occurs with lateral muscle or conjugate gaze palsies; elevated or depressed chin posture occurs with disturbances of groups of elevator or depressor muscles. Descriptions of these are found in standard texts of ophthalmology.

Case 1 demonstrated a depressed chin posture due to bilateral superior oblique palsy. Case 2 showed a downward head position with ocular elevation as a vain effort to use the available superior peripheral retinas for light stimuli. Case 8 demonstrated head-turn because of conjugate gaze palsy.

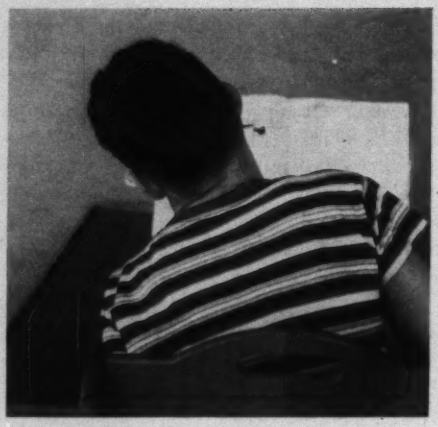

Fig. 1 (Diamond). Abnormal head position because of neck and upper extremity involvement or disturbed ocular motility makes reading extremely difficult. The use of a fixed reading frame may be helpful in these cases.

B. PALSIES OF OCULAR ELEVATION AND DEPRESSION

CASE 6

(Cerebral palsy; spastic paraplegia and ataxia; palsy of ocular elevation; nystagmus; subnormal vision due to partial optic atrophy.)

This seven-year-old boy had spastic paraplegia and ataxia with diffuse central nervous system and cerebellar involvement. His teacher stated: "He goes everywhere unaided without bumping into things. Whenever he wants to see, he holds an object very close to his eyes and looks sideways. He cannot distinguish colors." Speech-sound development was that of a three-year-old child because of dysarthria and dysphonia. Subjective intelligible intercommunication was not possible.

Vision was unobtainable but was estimated to be considerably subnormal. He identified four-inch objects held six inches from the eyes but was unable to see headline-size print. Nystagmoid aimless lateral ocular movements were noted, with a preferred posture of the eyes in the extreme lateral positions of gaze, probably to minimize nystagmus. He was unable to elevate the eyes on following a light or upon command. Right eye fixation was preferred with jerky conjugate movements to the left.

Cycloplegic retinoscopy revealed a high compound myopic astigmatic error. The optic nerveheads had the white waxy pallor of partial optic atrophy. Retinal pigmentation was sparse. The macular regions appeared normal. The child was able to distinguish blue, red, and yellow lights.

The following ocular handicaps were noted: (1) subnormal vision due to partial optic atrophy; (2) nystagmus associated with poor vision and cerebellar involvement; (3) ocular elevation palsy of supranuclear origin.

This child was not considered as partially sighted since sight-saving aids would be inadequate. Therefore, Braille teaching was recommended, if his motor involvement made learning possible.

Perry[14] pointed out that the sense of touch used in teaching the blind is not always accessible to the blinded cerebral palsied child because of the impairment in muscle control, and that to learn Braille a steady hand is necessary.

Case 7

(Cerebral palsy, mixed type; athetosis and ataxia secondary to Rh incompatibility; emmetropia with normal vision; elevation and depression palsy.)

This five-year-old boy had a medical history of prematurity and neonatal jaundice due to Rh incompatibility in the parents. He displayed severe bilateral hearing loss, delayed speech and language problems.

Eye examination revealed straight eyes with occasional spasmodic conjugate elevation. According to his teacher the child had difficulty with varying levels or lines of printed matter, although he seemed to see well.

Ocular movements were normal in the lateral directions of gaze but there was considerable difficulty in initiating vertical movements, especially voluntary ocular depression. The vision, refraction, and eyegrounds were noted to be normal. The child's reading problem of shifting from one line to the other was thought to be related to his difficulty in initiating vertical eye movements, especially depression. In order to maintain the eyes in a set primary position for the blackboard and for the reading distance, it was suggested that the printed matter be mounted on a vertical sliding panel so that it could be shifted into position.

C. Conjugate gaze palsy

Case 8

(Cerebral palsy; tension athetoid quadriplegia due to Rh incompatibility; left conjugate gaze palsy.)

Subjective communication with this 13-year-old girl was impossible because of speech difficulty and bilateral hearing loss. She could feed and dress herself but, due to her motor difficulty, needed help with buttons and fasteners.

Visual acuity was estimated at 20/30, both eyes (E test), and appeared to be normal for near. She exhibited spastic movements of the head and neck, and periodic head-tilt to the right shoulder with head-turn to the right. The eyes were straight and ocular movements appeared to be unrestricted except for left conjugate gaze which was difficult to initiate. She preferred to move her head rather than the eyes. Follow movements to a fixated target were possible in all directions and also to the left, if they were accomplished slowly and gradually but not with fast target motion. She could not initiate conjugate eye movements to the left on command only.

Cycloplegic retinoscopy and funduscopy revealed normal findings. Absence of hemianopsias was shown by testing with a toy airplane target and confirmed by normal blink reflexes in the peripheral fields. The difficulty of conjugate gaze to the left was considered to be due to the loss of normal fixational reflexes in that direction. Compensatory head-turn was involuntarily used to aid fixation on the left side; eye movements to the left were aided by slowly following an object. It was suggested, as an aid in reading, that the child use her finger as a pointer in guiding the eyes to the left to facilitate re-fixation.

D. Alternating hyperphoria

The case below exemplified the fairly common difficulty of reading among cerebral palsied children. Perry,[14] pointed out that the uncontrollable eye and head movements keep the eye off the printed page.

Case 9

(Cerebral palsy; mental retardation; alternating hyperphoria; convergence palsy; reading problem; strephosymbolia?)

This 10-year-old boy had difficulty in reading and writing. He was in the fourth grade, somewhat backward and retarded. He was reluctant to read and it was also difficult for him to write on oral command.

Cycloplegic refraction revealed no significant refractive error and the eyegrounds were normal. Vision was 20/20 in both eyes. An alternating bilateral hyperphoria was noted, associated with overaction of the inferior obliques, secondary to congenital palsy of the superior recti. In addition, convergence could not be elicited and the pupil reactions were noted to be sluggish. The double hyperphoria measured 30 prism diopters on the major amblyoscope.

He demonstrated simultaneous binocular vision with paramacular fusional amplitude but had central suppression of the right eye. It was considered possible that this muscle inco-ordination made reading difficult, slow, and confused by acting as a mechanical hindrance to binocularity. His reluctance to read was considered a possible result of this confusion. He had a history of initial left-handedness with a recent partial shift to righthandedness, which suggested strephosymbolia or congenital word aphasia.

The left eye was occluded for a period of time in order to evaluate further the effect of the vertical muscle imbalance on his reading ability. How-

ever, this trial of occlusion did not seem to affect his inability to read and it was concluded that his difficulties were of higher cortical origin. Follow-up, after eight months, revealed some spontaneous improvement in binocularity and his eyes were straight most of the time in the primary position. His mother stated that he had improved in reading and was doing better in school.

E. Convergence palsy

Case 10

(Cerebral palsy; athetosis with speech defect; convergence palsy.)

This nine-year-old boy preferred to tilt the head toward the left shoulder, with head-turn to the right. There was a tendency to depress the chin with the eyes in a position of elevation on attempted reading. The eyes were straight with good ocular motility and binocular co-operation for distance fixation. The child knew his alphabet, enjoyed the movies, and laced his shoes without difficulty. There were moderate involuntary athetoid movements of the neck and head and he was reluctant to initiate left lateral conjugate gaze but could do so with effort. A relative exotropia at the near-point, due to lack of convergence, was observed. This measured 20 prism diopters at 10 inches. He demonstrated 30 prism diopters of fusional amplitude and could appreciate diplopia on the major amblyoscope.

Vision for distance and near was normal. Homatropine refraction revealed a moderate hyperopia consistent with his age. It was believed that the unusual head posture represented an attempt to minimize diplopia while reading. Instructions were given to retrain head posture for the normal reading position with the eyes slightly depressed. Reading matter was to be held no closer than 13 inches from the eyes. Optical correction incorporating 10 prism diopters base-in was given for near only. If this failed to obtain binocularity at near, then future surgery aimed at increasing the angle of convergence at the near-point, was to be considered. He was re-examined six months later and his mother stated that the glasses were of great help for reading and close work, both at home and in school. Therefore, the prismatic correction was continued for close work only and surgical intervention was not advised.

Guibor[4] stated that spontaneous improvement occurred in many cases of ocular imbalance associated with cerebral palsy and suggested that surgery might be deferred for this reason.

F. Accommodation-convergence problems

As the cerebral palsied child becomes older and does more and more close work, the usual problems of accommodative and convergence asthenopia ensue. This is exaggerated in the cerebral palsied because of unusual head position, the need to hold reading material closer to take advantage of greater hand stability or to obtain a larger retinal image in ametropia or subnormal vision, or because of unusual problems of accommodation and convergence. Problems of training may arise which require a shorter reading distance, as illustrated by Cases 11 and 12.

Case 11

(Cerebral palsy; spastic left hemiplegia; mental retardation.)

This eight-year-old girl habitually held reading matter close to her face. She had no speech communication but seemed to hear well. Vision, subjectively unobtainable, was estimated to be normal in both eyes. Ocular motility was normal with no nystagmus; the eyes were straight in all directions of gaze. Cycloplegic refraction revealed +1.0D. sph. bilaterally. It was thought that the child held her reading matter closer because of greater hand stability and it was advised that a longer reading distance be used, perhaps with a reading frame.

Case 12

(Cerebral palsy; severe tension athetoid quadriplegia; convergence problem.)

This nine-year-old girl of average intelligence had severe athetoid involvement of the upper extremities. She was learning to type with her head by use of a pointer fastened to a football helmet and by striking the typewriter keys with a pointer. There was some speech difficulty but intercommunication was good.

The eye examination was essentially negative with the exception of a limitation of the convergence near-point to eight inches. Her vision was normal in both eyes. It was advised that print or near working material be placed no closer than eight inches from the eyes, and that the helmet pointer be adjusted to this distance in order to facilitate convergence and accommodation (fig. 2).

G. Spastic overconvergence

Case 13

(Cerebral palsy; athetoid quadriplegia; spastic overconvergence; strephosymbolia?)

This 15-year-old boy had a history of frequent reversals of letters in writing. He was ambidextrous, but preferred the right hand. His speech articulation was poor; he was deaf and read lips. Communication was excellent. There was a question raised in the medical history as to the possibility of aphasia. The eyes appeared straight, with occasional spastic overconvergence on attempted convergence.

Fig. 2 (Diamond). Case 12. A helmet pointer or striker is sometimes used for typewriter communication when upper extremity involvement makes hand use impossible. Problems of accommodation and convergence may arise in this connection.

Ocular ductions were normal. Unaided vision was: R.E., 20/30; L.E., 20/40 (E test). Cycloplegic refraction revealed +4.5D. sph. of hyperopia bilaterally. Vision was corrected to 20/25. Because the child's present glasses did not fully correct his hyperopia, new glasses were prescribed, incorporating full correction in order to discourage the occasional transient spastic overconvergence at the near-point. The history suggested a mild strephosymbolia or congenital word aphasia overlying the convergence problem.

III. Monocular amblyopia with presumptive loss of depth perception

The child with monocular amblyopia does not labor under as severe a visual handicap as the one with bilateral amblyopia, for he has good vision in his other eye for the usual daily tasks. However, a certain degree of depth perception is helpful in his daily needs and in his daily play. When vision in one or both eyes falls below 20/40, then depth perception becomes faulty and it becomes worse with increasing monocularity (Sloane and Altman[15]). Strabismic amblyopia and suppression is usually profound and it must be presumed that depth perception is deficient. This information may be of help in training the child and assisting him to avoid ocular hazards. Safety corrective glasses may protect the sound eye against the bumps and bruises of inco-ordination. Alternating strabismus with obvious absence of binocularity also implies deficient depth perception.

A. Strabismic amblyopia

Although the incidence of strabismus is highest in reported studies, it is not the most important disability from a visual or rehabilitation aspect. It should, of course, receive serious consideration and optical or surgical correction be used when indicated for maximum binocular coordination.

Case 14

(Cerebral palsy; severe motor aphasia; mental retardation; low-angle concomitant esotropia with suppression amblyopia.)

This seven and one-half year-old boy had a history of delayed speech, partial deafness, and motor development. He had congenital heart disease with the diagnosis of pulmonary stenosis established by cardiac catheterization. He seemed to lack alertness toward his environment from a visual standpoint, and consequently the parents questioned his visual ability. They stated that the child wanted to look at things sideways but seemed to have good vision.

Inspection revealed normal head posture and conjugate gaze movements. There was a low angle esotropia of the right eye and it was difficult to obtain any prolonged fixation with either eye. Unaided vision was: R.E., 20/70; L.E., 20/30 (E test). Cycloplegic refraction showed: R.E., +3.0D. sph. $\frown$ +0.5D. cyl. ax. 90° = 20/70; L.E., +3.0D. sph. $\frown$ +0.5D. cyl. ax. 90° = 20/30. The presence of esotropia and monocular amblyopia was no particular visual handicap, since adequate vision was available for learning speech sounds through tactile and visual impressions.

B. Nonstrabismic monocular amblyopia

Case 15

(Mixed type of aphasia; hearing and speech defect; prematurity; amblyopia due to congenital corneal opacity.)

This seven-year-old boy of normal intelligence had bilateral hearing loss, speech defect, and mixed aphasia. He had minimal neurologic involvement. Ocular evaluation revealed amblyopia of the right eye, due to congenital corneal opacity and irregular corneal astigmatism with maximum vision of 20/200 (E test). The left eye was entirely normal, with normal vision and refraction for his age. Depth perception was presumed to be faulty and this was taken into consideration in his daily routine. It was also thought advisable to take adequate measures to avoid any hazard to his normal left eye.

IV. Visual field defects

Tizard, Paine, and Crothers[16] pointed out the fairly high incidence of homonymous

hemianopsia and ipsilateral sensory impairment in children with hemiplegia. Homonymous hemianopsia was present in approximately 25 percent of their cases, and almost all of these also showed sensory deficiencies. They suggested perimetry, when feasible. Good results were obtained by the confrontation method with simultaneous digital stimuli in both fields. Among very young children (below the age of five years) they noted that a definite indication of hemianopsia could be obtained by passing coins or attractive objects around the patient's head from behind while attempting to attract his gaze in a forward direction. They also noted an almost uncontrollable shifting of the eyes toward the side affected by hemianopsia.

Visual field defects may be estimated objectively, and this is quite often the only method available in the absence of subjective communication. Blink reflexes should be carefully observed when noxious light stimuli or sudden hand movements are presented at the lateral or medial fields with fixation attracted forward. In this manner a homonymous defect may be uncovered even in infants. If a bright or attractive object is brought unknowingly into the peripheral field, often the child will make a conjugate gaze movement toward the object. If this is carefully observed to be lacking on one side, a homonymous hemianopsia may be strongly suspected. This test may be done with each eye alternately covered.

CASE 16

(Posttraumatic encephalopathy with bilateral brain damage; bilateral partial optic atrophy; right homonymous hemianopsia.)

This eight-year-old boy had a history of severe malnutrition during the first year of life. At 13 months of age he sustained a head injury followed by surgical removal of a subdural hematoma. Follow-up ventriculograms at the age of six years revealed a profound degree of brain damage. He exhibited normal intelligence but had a short memory span. Intercommunication was difficult because of the cerebral palsy problem.

Inspection revealed a tendency for head-turn to the right with eccentric fixation. Fine nystagmus with left conjugate gaze was noted. Vision was estimated at 4/200 for distance, and 14/84 at four inches (E test). Cycloplegic retinoscopy revealed a moderate degree of hyperopic astigmatism, the correction of which did not significantly improve vision. The optic discs were sharply outlined with a waxy-white pallor. This was thought to represent a partial optic atrophy. There was a definite right homonymous hemianopsia as revealed by blink tests and response to confrontation hand movements.

As he appeared to have no particular difficulty in reaching and grasping for objects which commanded his attention, the child was considered partially sighted with subnormal but useful vision.

CASE 17

(Right spastic hemiparesis with some mental deficiency, posttraumatic; right homonymous hemianopsia.)

This 20-year-old girl suffered a traumatic right hemiplegia at the age of 18 years following an automobile accident. Her medical history revealed some mental deficiency with short memory secondary to traumatic brain damage.

The patient had difficulty in recognizing alphabet letters and was tested with the illiterate "E". Unaided vision was 20/400 in both eyes for distance; 14/112 in the right eye and 14/224 in left eye for near. The pupils were wide (four mm.), slightly irregular, and sluggish to light reflex. Cycloplegic refraction revealed a moderate degree of myopia. Funduscopy revealed a moderate degree of bitemporal optic nerve pallor. The perimetric peripheral fields revealed a sharp distinct right homonymous hemianopsia with splitting of the macula.

The difficulty in recognizing the examining alphabetical letters was thought to be on the basis of word aphasia. Her difficulty in vision was apparently due to the splitting of the macula. The field defect was believed to be an obstacle to the normal fixational pattern of reading from left to right. The use of the finger or pointer was suggested as an aid in reading.

V. COMBINED DEFECTS

Incidence statistics fail to reveal the high incidence of combined defects, each of which must be considered in evaluating the visual handicap. For instance, Case 1 showed a combination of congenital high myopia, subnormal vision due to partial optic atrophy, and bilateral superior oblique palsy. Case 3 revealed a combination of subnormal vision due to partial optic nerve atrophy, nystagmus, ocular elevation palsy, and a high degree of compound myopic astigmatism of both eyes.

VI. ASSOCIATED CONGENITAL OR DEVELOPMENTAL DEFECTS

Congenital myopia occurred in Case 1, alternating hyperphoria in Case 9, and con-

genital corneal scar in Case 15. Strephosymbolia, or congenital word aphasia, could conceivably occur with cerebral palsy, and its occurrence was suggested in Cases 7 and 13. Breaky[5] reported the association of congenital cataracts, iris coloboma, and spastic eyelids. Strabismus fixus, spasmus fixus, coloboma of the macula, ptosis, and pseudopalsy externi were reported by Guibor.[4,17]

Summary and Conclusions

A few of the many and varied problems that may arise in cerebral palsy from a visual and oculomotor standpoint have been presented. These problems are of immense concern for the proper diagnosis, education, and rehabilitation of the cerebral palsied child. The ophthalmologist can be of aid to the cerebral palsy team by giving an accurate appraisal of the visual, visuosensory, and oculomotor assets. Conversely, he can point out the ocular handicaps and make valuable suggestions as to possible remedial measures.

The various visual handicaps that confront the cerebral palsied child have been outlined in order of relative comparative importance for education and rehabilitation, with illustrative cases, and some suggestions for aiding or overcoming them have been pointed out. Quite often simple measures may be of great benefit.

The difficulties of visual evaluation and recommendations for teaching by Braille or by sighted aids are illustrated in Cases 1, 2, 3, 4, 6, and 16. The use of a reading panel or frame in vertical or lateral gaze palsies or for hand instability is suggested in Cases 7 and 11. Fixational problems due to disturbed ocular motility or field defects may be aided by the use of a pointer to guide fixation and refixation, (Cases 8 and 17). The use of a helmet pointer for typewriting when there is severe upper extremity involvement (Case 12) and ways to overcome accommodation and convergence problems associated with the use of a helmet pointer (Case 12) are pointed out. The many reading problems, usually due to disturbed ocular motility (Cases 7, 9, 10), or complicated by an overlying word aphasia (Cases 9, 13), may be aided by the use of prisms (Case 10), selection of proper reading distance, and full correction of ametropias (Case 13).

Visual evaluation is at times extremely difficult due to the lack of intercommunication. Newer methods of objective visual evaluation may help greatly in this regard. If subjective tests are applicable, the task is much easier; however, usually subjective means of intercommunication are interrupted by the cerebral palsy process which includes hearing and speech defects and the ophthalmologist must rely on accuracy of observation and skill of objective examination and interpretation of findings. These patients present the most intriguing problems in aiding the ocular handicap, either medically (use of atropine in spasmus convergens as shown by Guibor[4,17]) or by optical, physical, or surgical means. Guibor[8] believes that, when indicated, lenses, prisms, and atropine cycloplegia may aid in correcting and overcoming abnormal eye movements, help in co-ordinating oculomotor activity and, thus, aid walking and the use of the hands.

Referring physicians, teachers, therapists, and parents of the cerebral palsied child are primarily interested in a practical interpretation of the eye findings which can aid them in handling the child. They are unable to interpret technical eye findings and are primarily interested in:

How well does he see?—and—What can we do about it? It would be extremely helpful to interested physicians and cerebral palsy ancillary workers to report vision as: (1) subnormal, blind, or nonuseful, with a recommendation for teaching as a blind child; (2) subnormal, useful, or partially sighted, with recommendations for teaching by visual aids; (3) one-sided subnormal vision and some estimate of evaluation of depth perception for training purposes, avoidance of ocular hazards, and suggested safety measures; (4) normal vision, on the basis of subjective tests, or presumptive

normal vision, on the basis of objective findings, observation, and clinical impression.

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NODULAR NONSUPPURATIVE PANNICULITIS (WEBER-CHRISTIAN SYNDROME) WITH RELAPSING UVEITIS*

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The characteristic clinical and histopathologic features of this syndrome were described already in 1892 by Victor Pfeiffer.[1] In 1925 Weber[2] gave it the name of relapsing, nonsuppurative, nodular panniculitis, and a few years later Christian[2] added the adjective "febrile" to this already formidable term, which could be abbreviated to "relapsing nodular panniculitis" at the present state of knowledge, since it is not always febrile and not always nonsuppurative.

The disease has been reported at all ages and in both sexes, with a slight predominance in females, and in all degrees of severity. The most characteristic clinical feature is the appearance of subcutaneous nodules of varying sizes, at first usually on the thighs and legs. They are slightly or markedly tender and the overlying skin is usually hyperemic and warm. The eruption of the nodules may be accompanied by variable degrees of fever and malaise. When present the fever is of the septic type.

The nodules may disappear without leaving a trace or leave behind a slight retraction of the skin due to subcutaneous atrophy.

The histopathologic changes in a focus of

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Fig. 1 (Klien). Fundus of right eye of woman, aged 63 years. Acute central chorioiditis, relapsing iridocyclitis prior to and since its development but not simultaneous with it, nodular panniculitis for eight months prior to it. Convex inferior border of lesion indicates exudative character, shadows above and below it suggest some elevation. Fine radiating folds over inferior macular region.

panniculitis go through three phases (Friedenberg[4]): The earliest stage is characterized by edema, congestion, necrosis of fat cells, and invasion of inflammatory cells, predominantly lymphocytes and monocytes. Berman[5] has stated in this connection that these two types of cells contain the most of the enzyme lipase. See also Figure 2 in this text.

The second stage is marked by the appearance of large, lipophagic histiocytes with somewhat foamy cytoplasm, and of an occasional giant cell.

In the third stage fibrosis occurs at the site of the destroyed fatty tissue. Periarteritis and intimal proliferation in the arterioles is pronounced within the damaged area at this stage. Calcification in an area of fat breakdown has been mentioned by Bunnell and Levy.[6]

For many years the disease was thought to be limited to the subcutaneous panniculus. Its systemic aspects were unrecognized until 1953 when Steinberg[7] surveyed the cases in the literature and some of his own and established it as a systemic disease, possibly a special type of antigen-antibody reaction.

Extensive involvement of visceral fat deposits and even two deaths from it with necrosis and fatty infiltration of the liver have been reported (Mostofi and Engleman[8]). In this connection one is reminded of the fact that the liver is a well-known shock organ in allergy, and that the adipose tissue may also serve as one in predisposed individuals.

The etiology of this syndrome is unknown. Bacterial and viral infections, chemical (bromides, iodides) and physical trauma have all, at one time or another, been thought to be eliciting factors. It has also been found coupled with tuberculosis, Hodgkin's disease (Shulman[9]), and rheumatic fever (Kennedy, et al.[10]).

The specific reaction of fat tissue, as Beeman has pointed out, is related to its chemical composition. Various agents will have an identical effect upon it. Thus the conception of an antigen-antibody reaction in predisposed individuals, which may alter the chemical nature of the fat, sounds acceptable. The adipose tissue becomes foreign to the body in such a case, and a chain of pathologic events is set up which would be the same regardless of a microbial, or a chemical, or a traumatic precipitating factor.

It is interesting in this connection that changes analogous to the human nodular panniculitis could be produced in rabbits with a variety of antigens with and sometimes without prior sensitization (Duran-Raynals[11]).

Treatment of the nodular eruptions with roentgen rays has been successful in some cases (Sandifer[12]); ACTH and cortisone reduce fever and malaise but have little effect upon the nodes (Crosbie[13]). Neither radiation nor steroid therapy seems to prevent recurrences.

No reports of uveitis associated with the Weber-Christian syndrome have so far appeared in the literature. However, in 1953 Theobald[14] demonstrated sections of an eye with anterior uveitis, obtained from a 22-year-old woman, who developed nodular panniculitis simultaneously with the onset of

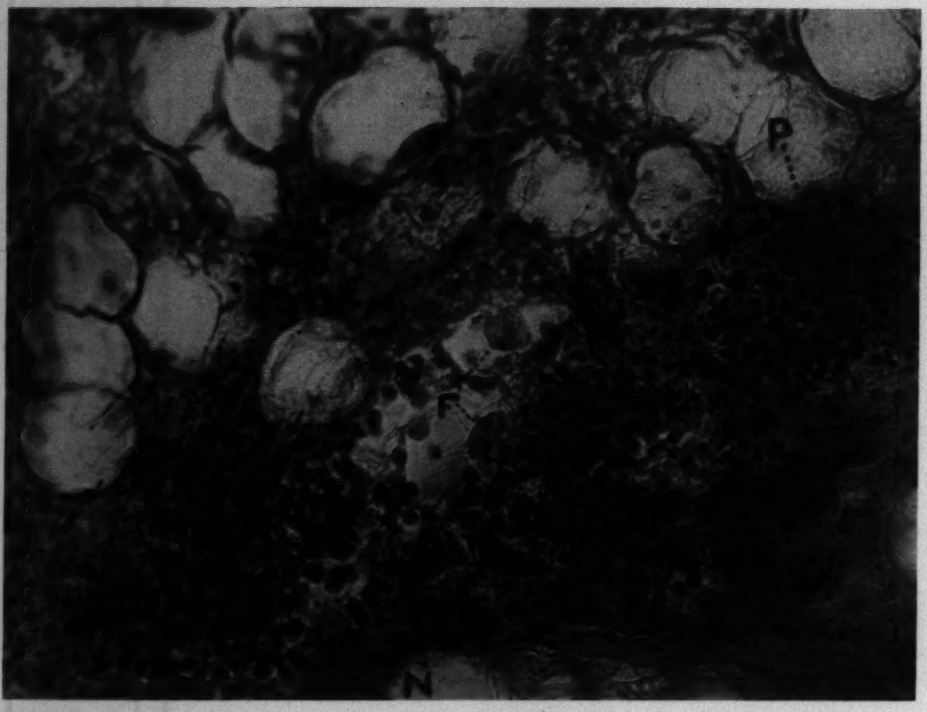

Fig. 2 (Klien). Area of panniculitis in orbital fat. The patient, a woman aged 22 years, died from Hodgkin's disease (case of Dr. John McGavic). In the terminal phase of her illness proptosis and edema of the eyelids developed. The orbital tissue showed marked venous stasis, edema and foci of panniculitis. (F) Lipophagic histiocytes around necrotic fat cells. (N) Infiltration with inflammatory cells, predominantly lymphocytes and monocytes, some polymorphs at (P).

uveitis. The eye was finally lost from secondary glaucoma. This girl had active tuberculosis at the age of eight years, which was declared inactive after many years of treatment.

Friedenberg suggested that nodular panniculitis is an infrequently recognized and reported rather than a rare disease and this may hold true also for its association with uveitis.

Reports have appeared in the recent literature of nodular panniculitis after massive prednisone therapy for rheumatic fever (Smith, R. T. et al.,[15] Taranta, A. et al.[16]). All of these patients were children. There appears to have been some difference in the clinical picture of these cases from typical Christian-Weber syndrome in as much as the face was always prominently involved, while in the usual case face, hands and feet are spared. So far this syndrome has not been recorded as a complication of steroid therapy in adults.

Report of a case

This woman, 63 years of age, had repeated short attacks of redness and blurring of vision occurring alternatingly or simultaneously in both eyes for two years prior to her first admission in May, 1956, to the Albert Merritt Billings Hospital of the University of Chicago. During the first year there was spontaneous recovery from these attacks; during the second year, when she sought medical advice, they were diagnosed as iridocyclitis and cleared up again promptly under topical hydrocortisone and atropine medication and systemic therapy with meticorten.

She was referred* for further study because of the frequent recurrences of these attacks and per-

* For referral of this patient and the clinical data prior to March, 1956, I am indebted to Dr. Gustav D. Soltz, Arlington Heights, Illinois.

sistence of the last one in spite of the above-mentioned therapy.

Past general medical history. Surgery for a displaced urinary bladder and cystitis was performed in 1953. There was a recurrence of the cystitis in 1956 which cleared with oral Gantrisin medication. Otherwise the patient had been well.

At the first visit the corrected vision, R.E., was 20/25; L.E., 20/60. The globes were pale but many cells were noted in the aqueous and vitreous of both eyes. In the right iris there was a broad posterior synechia at the 4-o'clock position with slight thickening of the adjoining stroma. At the left pupillary border there were two Koeppe nodules but no synechias. The left macula showed microcystic edema, the right macula only slight edema without visible cystic degeneration.

General physical findings. Chest film: bilateral hilar calcifications but no other lesions. Abdominal film: calcifications of some mesenteric lymph nodes. Skin tests: first strength of purified protein derivate (PPD): four plus; histoplasmin: two plus. Brucella agglutination 1:80; toxoplasmosis dye test 1:64. Erythrocytes: 4,030,000; leukocytes: 8,950, with normal differential count. Sedimentation rate 44 mm./hr.; C-reactive protein one plus; albumin-globulin ratio: 4.9/2.8; streptolysin titer negative; febrile agglutination negative.

No bacteria could be cultured from urine specimens at that time.

A therapeutic test with isoniacid and para-aminosalicylic acid was carried out for one month without improvement of the iridocyclitis.

Meticorten therapy in small oral doses (10 mg. a day) was then reinstated and combined with achromycin (1,000 mg. daily), which cleared up all signs of active inflammation within three weeks, dissolved the right posterior synechia completely and restored the right vision to 20/20, the left vision to 20/40-2.

The patient remained symptom free for five months. Attacks of anterior uveitis in both eyes recurred in October, 1956, May and December, 1957, March and July, 1958, but always cleared up after two to four weeks with the therapy already outlined.

During the first observed recurrence in October, 1956, a firm posterior synechia had reformed in the right eye at the same site as before (4 o'clock), and two posterior synechias occurred in the left eye from the 4- to 6-o'clock positions and the 2-o'clock position.

All of these synechias disappeared during the latter part of 1956 but both of the left synechias reformed during one of the attacks in 1958 in exactly the same location as they had before.

Early in 1957 the patient mentioned for the first time tender nodes on her thighs and legs, the largest, measuring about 10 by 15 cm., being on the left inner thigh. The diagnosis* of nodular, nonsuppurative panniculitis was made and confirmed by biopsy.

* The clinical and histopathologic diagnosis was made by Dr. Francis J. Haddy, Arlington Heights, Illinois.

In August, 1958, a sudden diminution of the right vision occurred. Examination of the right fundus two weeks later revealed an oblong yellowish focus of chorioiditis just nasally to the fovea centralis (fig. 1). The lesion had slightly convex borders inferiorly, indicating an exudative character, and appeared to cast shadows above and below, suggesting an elevation. The overlying retina was edematous, showing concentric folds around the lesion and many fine radiating folds over the entire inferior macular region. The right vision was reduced to 20/60. Surprisingly, there was no recurrence of the anterior uveitis in either eye at that time.

The patient was admitted to the hospital for ACTH therapy which was started with 120 units and continued with 90 and 60 units for three days each respectively. During this week the right vision improved to 20/30. Also, the last palpable residua of the nodular panniculitis disappeared, and there has been no recurrence of the latter so far. The patient was discharged on oral therapy with Meticorten.

About this time, there was a recurrence of the cystitis which was treated with biweekly injections of streptomycin and irrigations with neomycin. The urine cultures at that time revealed Escherium coli.

In February, 1959, there was another recurrence of the anterior uveitis in both eyes with slight decrease in the right vision due to dense cellular suspensions in the vitreous. After five weeks of therapy with Decadron, tapering the dose from an initial 30 mg. to 0.75 mg., all signs of active inflammation disappeared. The chorioiditic lesion has become flat and inconspicuous without any pigmentary disturbances surrounding it, and with only slight residual retinal edema overlying it. The right vision has returned to 20/20, the reduction of the left vision to 20/60 appears to be permanent due to the microcystic degeneration of the macular retina.

Comment

The relapsing character of the uveitis has to be emphasized, together with the fact that the visible lesions in iris and choroid had a rather focal character with a tendency, at least in the iris, to reappear in exactly the same locations as they had occupied during a previous attack, even several years in the past.

Perhaps the intraocular lesions are as focal and as scattered as the nodular lesions of the panniculus, and constitute some antigen-antibody reaction at the site of a particular part of the vascular bed. It was especially remarkable that the acute chorioiditis was not accompanied by a flare up of the so frequently recurring iridocyclitis.

It may also be emphasized that the patient,

much concerned about the repeated ocular inflammations and the reduction of visual acuity, in this case just casually mentioned the lesions of the nodular panniculitis.

Similarly, this condition might be ignored by other patients with uveitis as relatively trivial. Special inquiry about its symptoms may reveal a more frequent association of the two conditions than heretofore thought.

Summary and Conclusions

A case of anterior and posterior uveitis associated with nodular panniculitis has been discussed. This association may be more common than the lack of reports in the literature leads one to believe. Its discovery might be important as an indication of a patient's sensitivity status and of possibly more widespread tissue responses to come. These may show all degrees of severity, as has been recognized during the past few years, from lethal midline granuloma and Wegener's granulomatosis to more focal disease such as segmental idiopathic arteriolitis (Klien,[17,18] Straatsma[19]). Inspection for the panniculus should be included in the physical examination of all patients with uveitis.

While this patient was on steroid therapy prior to the onset of the panniculitis, she did not have massive doses of it up to that time, and later when massive doses were employed for therapy of the uveitis, the panniculitis did not recur. It is unlikely therefore, that it was a reaction to steroid therapy in this case. The conception of its pathogenesis as an antigen-antibody reaction after some form of bacterial or viral infection is supported in this case by the association with the relapsing uveitis, which may also have this origin.

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THE OPHTHALMODYNAMOMETRIC POSTURE TEST*

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The urgency of instituting prompt therapy for carotid arterial occlusive disease has made ophthalmodynamometry a diagnostic procedure of great importance. In an effort to facilitate early detection of carotid insufficiency, study of the changes in ophthalmic arterial pressure with posture has been proposed by techniques previously described.[1] This paper summarizes data obtained in a series of patients with and without cerebrovascular disease seen in neuro-ophthalmologic consultation in the Massachusetts General Hospital between July, 1958, and March, 1959.

TABLE 1
CLINICAL DIAGNOSES

Group III	Cerebrovascular Disease
Diagnosis	No. Cases
Internal carotid insufficiency	12
Middle cerebral thrombosis	11
Basilar insufficiency	2
Diabetes with postural vertigo	2
Middle cerebral embolism	1
Cerebral hemorrhage	1
Pulseless disease	1
Carotid-cavernous fistula	1
Postoperative thromboendarterectomy	1
	32

THE POSTURE TEST

The ophthalmic arterial systolic and diastolic pressures have been measured in both supine and erect positions. These values have been correlated with brachial arterial blood pressures determined in the same positions. This series consists of 79 cases divided into three groups† as follows: (1) Group I—16 young healthy normal adults; (2) Group II—31 older patients without cerebrovascular disease (but with other neurologic disease); (3) Group III—32 patients with frank cerebrovascular disease.

Of the cases with cerebrovascular disease (Group III), clinical diagnoses were as in Table 1. The data for both systolic and diastolic values have been analyzed for the following points: (1) correlation between ophthalmic and brachial arterial blood pressures in both supine and erect postures; (2) the effect of posture on the difference in ophthalmic artery pressure in the two eyes; (3) the uniocular response of ophthalmic artery pressure to posture, and the effects of age, hypertension, and cerebrovascular disease on this response.

I. CORRELATION BETWEEN OPHTHALMIC ARTERY AND BRACHIAL ARTERY PRESSURES

To investigate the correlation between ophthalmic and brachial arterial blood pressures, the ratio of ophthalmic artery pressure in units to brachial pressure in mm. Hg (*O.A./B.A. ratio*) was determined for both systolic and diastolic values, and in both supine and erect positions. The values in Table 2 were obtained.

From Table 2 it is seen that the O.A./B.A. ratio is higher for systolic values than for diastolic values, and is also somewhat higher in the supine than the erect position. On the

* From the Howe Laboratory of Ophthalmology, Harvard University Medical School, and the Massachusetts Eye and Ear Infirmary. This work was supported in part by Special Traineeship BT 357, National Institute of Neurological Diseases and Blindness.

† In Group I, the posture test was done with direct ophthalmoscopy and without mydriasis. More precise end-points were obtained in Groups II and III by employing indirect ophthalmoscopy and maximum mydriasis.

TABLE 2

OPHTHALMIC ARTERY/BRACHIAL ARTERY PRESSURE RATIO

	Group I	Group II	Group III	Groups I and II (controls)
Supine				
systolic	81.1%	77.6%	73.7%	78.9%
diastolic	72.4%	66.7%	64.3%	71.1%
Erect				
systolic	79.8%	76.5%	68.8%	77.8%
diastolic	66.0%	65.8%	57.6%	65.9%

average the ophthalmic arterial pressure comprises about two thirds of the respective brachial diastolic pressure, and three fourths of the brachial systolic pressure. These data are in remarkably good agreement with the reported diastolic values of Perry and Rose.[2]

II. COMPARISON OF OPHTHALMIC ARTERY PRESSURES IN THE TWO EYES AND THE EFFECT OF POSTURE ON THIS RELATIONSHIP

The difference between ophthalmodynamometric values in the two eyes is given in percent for the three groups of patients in Table 3.

In Table 3 Group III (cerebrovascular disease) has been divided into cases with and without carotid artery disease. The greater disparity in the two eyes of Group III as a whole is then seen to be due to the cases with carotid insufficiency. With ophthalmic artery pressures in the normal range, and using indirect ophthalmoscopy, adequate mydriasis, and an experienced assistant, the reproducibility of the method is such that a consistent difference in diastolic values of six units or over, and in systolic values of 10 units or over appears definitely pathologic. Hollenhorst[4] reported that a difference of 10 percent or over of ophthalmic arterial pressure indicates reduced carotid flow on the side of the lower pressure, and and our experience is in agreement with this. From Table 3 it appears that a greater difference in ophthalmodynamometric values in the two eyes is more often encountered in the supine position than in the standing posture. The significance of this finding will be brought out more fully later in this report.

III. THE RESPONSE TO POSTURE

A. CHANGE IN OPHTHALMIC ARTERY PRESSURE ON STANDING FROM THE SUPINE POSITION

The change in ophthalmic arterial pressure on standing from the supine position varied in the three groups, as is seen in Table 4.

In Table 4 Group III has again been

TABLE 3

DIFFERENCE IN OPHTHALMIC ARTERY PRESSURE IN THE TWO EYES*

(Averages—in percent)

	Supine		Erect	
	Systolic	Diastolic	Systolic	Diastolic
Group I	5.9%	8.3%	3.4%	7.7%
Group II	5.5%	6.6%	4.0%	4.3%
Group III	14.3%	9.4%	12.9%	11.4%
Carotid insufficiency	21.2%	16.4%	23.5%	16.9%
No carotid insufficiency	7.7%	4.4%	5.2%	8.1%

* The difference in percentage between the two eyes include all cases in each group, and those with different brachial pressures were not excluded as was done by Thomas and Petrohelos.[3] Atheromatous disease may affect vessels in the upper extremities distal to the origin of the common carotid and innominate arteries. In such cases equal ophthalmic artery pressures with significantly different brachial arterial pressures may be encountered.

TABLE 4

CHANGE IN OPHTHALMIC ARTERY PRESSURE ON STANDING FROM THE SUPINE POSITION

	Fall Systolic		Rise Systolic		Fall Diastolic		Rise Diastolic	
	No. Cases	%	No. Cases	%	No. Cases	%	No. Cases	%
Group I	15	10.8	1	8.2	12	8.9	4	2
Group II	21	9.6	2	4.2	22	7.8	9	5.3
Group III	27	19.8	5*	3.5	28	13.5	4	10.8
Carotid disease	12	18.1	—	—	11	14.1	1	13
No carotid disease	15	18.5	1	6	15	14.1	3	9

divided into those cases with and without carotid insufficiency.* Note that the response to posture was essentially the same in these two types of cerebrovascular disease. The most significant finding in this table, however, is that a greater fall in ophthalmic artery pressure on standing occurred in patients with cerebrovascular disease (Group III) than in the controls (Groups I and II). This was noted in both systolic and diastolic measurements.

It is of interest to consider those cases in each group in which a fall of ophthalmic systolic and/or diastolic pressure of 20 percent or more occurred. In Group I, a systolic fall of 20 percent or more occurred in two individuals, and a similar diastolic drop was noted in a third patient. However, in no instance in Group I did a fall of this magnitude occur in both systolic and diastolic values simultaneously in the same person. In Group II, two cases had a fall in systolic and three cases had a fall of diastolic pressure of over 20 percent. A total of three cases in Group I and four cases in Group II thus had a response to posture of the same magnitude as that seen commonly in Group III (cerebrovascular disease). Of the three such cases in Group I, one had known postural hypotension, one was tense during the examination, and in the third no explanation was available. Of the four cases in Group II, one had been at bedrest, one had a cerebral neoplasm, one had traumatic Raeder's syndrome, and the fourth had postural hypotension. However, in Group III there were 15 cases with a fall in ophthalmic artery pressure (systolic or diastolic) of 20 percent or more. The fall in systolic pressure occurred in only one eye in six patients and in both eyes in seven others. In two cases, the fall occurred in diastolic values only. In one of the latter, systolic values had been too high to record, and in the other, systolics fell 5.5 percent whereas diastolics fell 28 percent with posture. The latter patient had diabetes and formerly had a right hemiparesis. Of these 15 cases, six had insignificant differences in ophthalmodynamometric values between the two eyes. As all cases in Group III had definite clinical evidences of cerebrovascular disease, these six cases showed a marked response to posture as the only abnormality on ophthalmodynamometry. It may be that the response of the cerebral circulation to posture as studied by this test may be of value in cases of cerebrovascular disease involving other than the infraophthalmic carotid arterial system.

B. AGE AND THE POSTURE TEST

The O.A./B.A. ratio was studied with respect to age by subdividing Groups II and III (table 5).

It is seen from Table 5 that in Group II there appears to be little effect of age alone on the O.A./B.A. ratio.

C. HYPERTENSION AND THE POSTURE TEST

The effect of hypertension on the O.A./

* Four of the five patients in Group III who had a rise in ophthalmic systolic pressure on standing had carotid insufficiency. In these cases the rise was uniocular, however, and occurred on the uninvolved side concomitant with a significant drop in the ipsilateral eye.

TABLE 5

AGE AND THE O.A./B.A. RATIO

	Supine		Erect		
	Systolic	Diastolic	Systolic	Diastolic	
Under 45 years of age	76.6%	66.1%	76.8%	69.1%	—Group II
Over 45 years of age	78.1%	66.7%	78.2%	64.7%	
Under 55 years of age	—	55.3%	64.1%	55.6%	—Group III
Over 55 years of age	79.0%	65.8%	73.2%	60.2%	
Under 45 years of age	73.4%	67.7%	75.2%	62.9%	—Groups II & III combined
Over 45 years of age	77.2%	66.9%	75.3%	62.0%	

B.A. ratio was evaluated in Groups II and III by the following subgroups: (1) normotensive (patients with supine brachial blood pressures less than 160/95 mm. Hg); and (2) hypertensive (those with supine brachial blood pressure greater than 160/95 mm. Hg). The values are seen in Table 6.

It is seen from the data in Table 6 that the O.A./B.A. ratio appears to rise as the systemic blood pressure rises. It should be pointed out that the Bailliart ophthalmodynamometer employed has a maximum scale reading of 150 units, and often in hypertensive patients, arterial pulses are still visible when this amount is exerted on the eye. Obviously, the exact ophthalmic systolic pressure is unknown in such a case, and has been recorded as 150+ in these instances. Thus, the systolic O.A./B.A. could not be calculated in three fourths of the hypertensive individuals in this series. The systolic values given for hypertensive patients above are thus biased towards those less severely affected patients with ophthalmic arterial pressures below 150 units. A rise in the O.A./B.A. ratio for diastolic values was reported by Perry and Rose,[2] and our data indicate a rise for both diastolic and systolic values.

DISCUSSION

In this study the ophthalmodynamometric values recorded are those given directly in units on the Bailliart instrument. Through the courtesy of Dr. H. T. Ballantine, Jr., in two instances of internal carotid aneurysm, ophthalmodynamometry was correlated with pressure readings obtained at direct needle manometry of the internal carotid artery. In the first case, direct manometry revealed a mean pressure of 62 mm. Hg in the internal carotid, and ophthalmodynamometry performed two hours later disclosed 68/50 units in that eye. In the

TABLE 6

HYPERTENSION AND THE O.A./B.A. RATIO

	Supine		Erect		
	Systolic	Diastolic	Systolic	Diastolic	
Normotensive	78.9%	67.3%	76.9%	66.1%	
Hypertensive	75.6%	65.7%	77.2%	66.3%	—Group II
Normotensive	76.4%	63.9%	68.7%	55.2%	
Hypertensive	—	72.5%	—	65.6%	—Group III
Normotensive	—	65.8%	71.9%	60.9%	
Average	78.2%	67.2%	73.8%	63.1%	—Groups II & III
Hypertensive	—	73.2%	81.7%	67.6%	

second case, ophthalmodynamometry was done in the operating room simultaneously with direct internal carotid manometry. The carotid pressure was 80/60 mm. Hg while ophthalmodynamometric values were 75/55 and 81/55 units on two repeat determinations.

It was noted clinically in this study that in most healthy young individuals the ophthalmic artery pressures were not only essentially equal in the two eyes but showed no significant change on standing from the supine to the erect position. Occasionally a slight elevation was noted on standing, and this was usually seen in those individuals who appeared robust and with good vascular tonus. A fall in ophthalmic arterial pressure on standing was noted somewhat more frequent in the older patients, but the data indicated that the presence of cerebrovascular disease is a more potent factor than is age per se in this regard. The effects of posture could not be evaluated in a considerable proportion of cases of cerebrovascular disease as the patients were either unable or too ill to stand, but the ophthalmodynamometric data in that group, although interesting, is not the subject of this discussion.

In approximately 100 cases of cerebrovascular disease seen to date, six cases have been encountered in which the posture test has shown an unimpressive or equivocal difference in ophthalmodynamometric values in one posture, but a diagnostic difference in ophthalmic arterial pressures in another position. This has been of definite help in the clinical study of cases suspected of internal carotid insufficiency. A greater difference between the two eyes had been expected in the erect posture, but, interestingly, more often a greater disparity was noted in the supine posture. Final evaluation of this test awaits further study, and in particular arteriographic and anatomic control studies are needed. Schiøtz tonometry has been performed frequently in this series and our observations agree with others[4] that moderate variations in intraocular pressure have no significant effect on clinical ophthalmodynamometry. Two "paradoxical" posture tests were noted in this study in which the ophthalmic artery pressure was lower on the unexpected side (that is, on the side contralateral to amaurosis fugax or ipsilateral to ischemic symptoms in the extremities). It appears that this finding indicates bilateral carotid disease, but further data are necessary to evaluate this phenomenon.

Summary

The effects of posture upon ophthalmic artery pressure have been studied using previously described[1] techniques. The present paper summarizes the data obtained in performing the ophthalmodynamometric posture test in a series of 79 patients. The series was divided into the following three groups: (1) Group I—16 young healthy normal adults; (2) Group II—31 older patients without cerebrovascular disease (but with other neurologic disease; (3) Group III—32 patients with frank cerebrovascular disease.

The data obtained appear to support the following conclusions:

1. In the normal person, the ophthalmic arterial pressures (which are equal in the two eyes) show little change on standing from the supine position. This change consists of either a slight drop or, less commonly and in more robust individuals, a very slight rise in ophthalmic systolic pressure. Specifically, in 90 percent of the control patients (Groups I and II), a fall in systolic ophthalmic pressure, averaging less than 10 percent, occurred on standing from the supine position. In the other normal controls, a rise of ophthalmic systolic pressure actually occurred on standing, averaging six percent. The diastolic values showed a smaller and less frequent drop with posture. Thus, in 75 percent of the controls, a diastolic fall averaging eight percent occurred. In the remaining 25 percent, a rise averaging three percent, was noted in the diastolic ophthalmic artery pressures on standing.

2. In patients with cerebrovascular disease, however, a greater drop in ophthalmic artery pressure occurs on standing. An average fall of 20 percent was noted in 85 percent of the cases in Group III. In the remaining 15 percent, a rise in systolic pressure averaging four percent occurred, often noted to be uniocular. The diastolic values likewise showed a greater drop with posture than in the control group. Thus, a drop of 11 percent in diastolic pressure occurred in 88 percent of the patients with cerebrovascular disease. In the remaining 12 percent a diastolic rise, averaging 11 percent, was noted. It is of interest to note that this drop in ophthalmic artery pressure on standing occurred equally in cases of cerebrovascular disease with and without carotid insufficiency.

3. Age has little effect upon the response of ophthalmic artery pressure to posture, in the absence of cerebrovascular disease.

4. The posture test appears to find its greatest usefulness in the diagnosis of internal carotid insufficiency. Thus, in five of 13 patients with carotid insufficiency who were well enough to permit the posture test, the difference in ophthalmic artery pressure in the two eyes was elicited in only one or the other position. These cases might have been overlooked if measurements had been made in one position only. In three of these five cases, the difference in ophthalmic artery pressures was brought out in the supine position, in one in the erect position, and in the fifth case, it was elicited in the supine position on one examination but in the erect position three months later! In a sixth patient studied five years after ligation of the left common carotid artery for an aneurysm, only a 12 percent difference in ophthalmic systolic pressures was evident in the erect position, yet a 24 percent inequality was apparent in the supine posture. In eight other cases with carotid insufficiency, the asymmetry in ophthalmic artery pressure was noted in both supine and erect positions, and thus a study with posture would have been unnecessary.

5. An incidental feature of this study was further correlation of the relationship between ophthalmic and brachial arterial pressures. The ophthalmic/brachial artery pressure ratio is higher for systolic than for diastolic values, and likewise is higher in the supine than the standing postures. The ophthalmic pressure is approximately two thirds of the brachial for diastolic values, and three fourths of the brachial for systolic values.

6. The ophthalmic/brachial pressure ratio rises as the blood pressure increases.

Conclusions

The ophthalmodynamometric posture test has been studied in a series of 79 patients with and without cerebrovascular disease. It appears useful in the early diagnosis of internal carotid arterial insufficiency. In five of 13 cases of carotid insufficiency, had ophthalmodynamometry been done in only one position the diagnosis might have been missed.

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PSEUDOMONAS CORNEAL ULCERATION

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Corneal ulceration following removal of a simple foreign body from the cornea is an unlooked for occurrence which may be due to corneal infection with Pseudomonas. Pseudomonas aeruginosa which is synonymous with Bacillus pyocyaneus or Pseudomonas pyocyanea is a gram-negative bacillus found on normal skin and in the intestinal tract of man. It is aerobic, produces a green fluorescent growth, and its pathogenicity for man depends upon the resistance of the host more than upon the virulence of the organism. Since penicillin has been widely used, suppression of gram-negative cocci by this antibiotic has so disturbed a balance between cocci and bacilli that infections with Pseudomonas are more frequent. When Pseudomonas attacks the cornea, it is refractory to therapy with usual antibiotics. When introduced into the cornea from penetration by a foreign body or contaminated solutions used for instillation or irrigation of the eye, it causes a deep, rapid, intense ulceration of the cornea which often leads to rupture of the globe with destruction of vision.

Experimental investigation

Experimental investigation of infection of corneas of albino rabbits with Pseudomonas was instituted in 1954.

1. The rabbit cornea was abraided and approximately 500 Pseudomonas organisms were rubbed into the abraided surface without the appearance of any corneal ulceration.

2. When approximately 2,000 virulent Pseudomonas organisms were rubbed into the denuded corneal surface, mild ulceration was produced in 50 percent of the corneas inoculated.

3. When 10,000 organisms of different strains of Pseudomonas were used, there was a variation in the incidence of corneal ulceration.

4. Examination of the blood serum and aqueous showed agglutinins to some Pseudomonas strains were present. When a strain of Pseudomonas was used to which the aqueous or blood serum had no agglutinins corneal ulceration occurred.

5. When Pseudomonas culture was later rubbed into rabbit's corneas that had experienced ulceration, no ulceration occurred because they had built up antibodies to this strain when previously inoculated.

6. Intracorneal injection of a culture of Pseudomonas aeruginosa produced corneal ulcer, hypopyon, and at times rupture of the cornea.

7. Subconjunctival injection of hydrocortisone aggravated all corneal infections, extending the ulceration until perforation occurred.

8. Subconjunctival injection of streptomycin was ineffective treatment against the progress of the ulcer nor did it change the positive Pseudomonas culture of the eye.

9. Subconjunctival injections of polymyxin produced negative culture for Pseudomonas but did not always arrest corneal ulceration.

10. After Pseudomonas disappeared from the eye, the cultures were positive for staphylococci, streptococci, gram-negative bacilli or other organisms. The ulceration progressed as though the Pseudomonas were present and led at times to corneal ulceration.

11. After inoculation of rabbits' corneas with Pseudomonas, the cultures remained positive for 48 hours with no contaminants, but after 72 hours, cultures became sterile or mixed with other organisms whether or not antibiotics were used.

This study of Pseudomonas infections of rabbit corneas, done at the South Bend Medical Foundation with the assistance of James W. Bahler, M.S., serologist, and S. G. Cilella, M.D., pathologist, was not reported at that time. In retrospect the variation in response

of rabbits to inoculation with Pseudomonas is not unusual. This organism is widespread in nature and the development of resistance to infections by rabbits, with their probability of encountering abrasions of the cornea, renders this animal not suitable for study of Pseudomonas ulceration of the cornea.

Literature

Fox and Lowbury[1] showed that rabbits had resistance by antibodies against most strains of Pseudomonas. Ross,[2] in testing the efficacy of Polymyxin B against experimental infection of rabbit corneas, concluded, because five were lost and five badly scarred, that Polymyxin had little or no practical value in therapy of eye infections with Pseudomonas.

Spencer,[3] in treating rabbit's eyes in which corneal ulcers had been induced, found that the ulcers (1) did not form, (2) were localized, or, (3) did not spread as rapidly depending on whether subconjunctival Polymyxin was started immediately at 24 hours or at 48 hours after inoculation with Pseudomonas.

Wiggins[4] found beneficial effects from Polymyxin in treatment of Pseudomonas-induced corneal ulcers of rabbits but, if used 24 hours after inoculation, the treated eyes showed progression of the ulcer, even though they did not perforate.

Ainslie and Smith[5] used polymyxin in treating Pseudomonas-induced corneal ulcers in rabbits and stressed that the corneal ulcer had no Pseudomonas in culture after treatment, but did not state the ulceration was arrested. Guerry and Williams,[6] in treating Pseudomonas-induced corneal ulcers in rabbits with polymyxin, found it beneficial when used subconjunctivally but, when their results were compared in treated and untreated rabbits, some severe ulcerations with extensive corneal scarring were in those treated with Polymyxin.

Fisher and Allen[7] reported that a proteolytic enzyme elaborated by Pseudomonas aeruginosa could cause severe ocular damage when inoculated intracorneally. They were able to purify partially this protease enzyme. This protease[8] has a proteolytic activity against collagen of the cornea. Antibodies are formed in response to the enzyme stimulus or are present at times in normal serum to combine with the enzyme to inhibit proteolytic activity of the protease.

The variation in resistance of various rabbit corneas from previous exposure to and development of antibodies against Pseudomonas or the protease enzyme makes experimental work with polymyxin against Pseudomonas-induced corneal ulcers in rabbits not as valuable as it should be. However, the merit of polymyxin in Pseudomonas ulceration of the cornea is not to be minimized. Unfortunately, when such a corneal ulcer is discovered, it has progressed 24 to 36 hours and, although the progress may be arrested, the corneal damage is extensive; although the globe may be saved, corneal scarring is often extreme.

Clincal study

Since my interest in experiments with Pseudomonas in rabbits in 1954, I encountered a series of Pseudomonas corneal ulcers which could have developed from some contamination of the cornea in a plant dispensary. These infections appeared sporadically so it was difficult to determine a source of the contaminant. The solutions, cotton, applicators, instruments used about the eye and every source of contaminant possible were investigated, cultured and recultured at various periods, but no Pseudomonas was found. Yet at irregular intervals, one or more patients, 24 or 48 hours after removal of a corneal foreign body developed a Pseudomonas corneal ulcer. Other patients would have foreign bodies removed from the cornea in the same plant on the same day, yet only in an isolated patient would an ulcer develop. Whether, as in rabbits, there is immunity of normal individuals to such an infection, and

why some eyes were not affected while others were, is as difficult to explain as the source of the corneal infections.

Twenty-four to 48 hours after onset, the conjunctiva was severely inflamed, swollen, and red and there was yellowish-gray ulceration from corneal necrosis. In some cases, there was hypopyon but, in all, a severe inflammation, photophobia and ulceration were progressing rapidly. Cultures showed Pseudomonas but treatment was instituted before the culture report was known. Neosporin ophthalmic solution which contains 5,000 units of polymyxin B, 2.5 mg. neomycin and 0.25 mg. gramicidin per cc. was instilled hourly into the affected eye while the patient was awake. Polysporin ophthalmic ointment which contains 10,000 u. polymyxin B and 500 u. bacitracin per gm. was used while the patient was sleeping. Polymyxin was often used systemically for a day or two by intramuscular injection four times daily.

Case reports

Case A29,000

C. F., aged 48 years, had a metal chip removed from the left cornea on August 10th. The following day the eye appeared normal. On August 12th pain and photophobia commenced and by August 13th, there was a semicircular grayish green ulcer in the left lower cornea (fig. 1). Descemet's membrane was wrinkled, the pupil miotic, and the surface of the ulcer abraided and necrotic. Culture from the ulcer showed Pseudomonas aeruginosa which seemed resistant in sensitivity tests to antibiotics including polymyxin B.

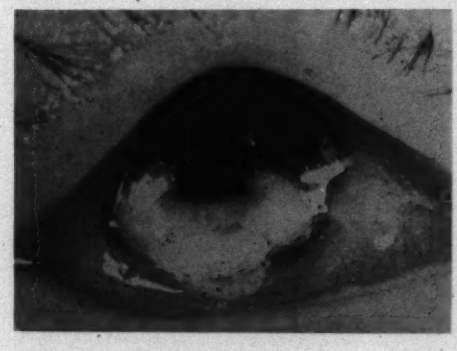

Fig. 1 (Cassady). Case A29,000. C. F., pseudomonas corneal ulcer, August 13th, O.S.

Fig. 2 (Cassady). Same case on August 19th.

On August 13th when the culture was taken and before it was reported, the patient was hospitalized, and treated with hourly conjunctival instillations of Neosporin ophthalmic solution while awake and Polysporin ophthalmic ointment during his sleep. Intramuscular injections of 50 mg. polymyxin B were given four times daily as well as one gm. oral doses of Chloromycetin every eight hours. On August 15th, when the sensitivity tests were reported, the Chloromycetin and systemic polymyxin were discontinued although the ulcer was definitely improved in appearance. Systemic sulfonamides in one-gm. doses every three hours together with ocular instillations of sulfacetamide were started to control secondary infection of the cornea.

By August 19th the ulcer was almost healed but some infiltration and staining persisted (fig. 2), although smear and culture from the eye showed no organisms. The patient was discharged from the hospital on August 27th; the ulcer was healed by September 1st. He returned to work September 10th and final visual acuity in his left eye was 20/25.

Case A29,695

D. A., aged 45 years, on September 4th said that a corneal foreign body had been removed from his eye August 30th and that on September 2nd when his eye became inflamed he started using hydrocortisone ophthalmic solution on recommendation of his family physician. A yellowish-gray corneal ulcer was present in the inferior nasal quadrant of his right eye (fig. 3). Culture showed Pseudomonas slightly sensitive to terramycin and polymyxin B. He was hospitalized, and treated by instillations of ophthalmic Neosporin solution hourly while awake and Polysporin ophthalmic ointment while sleeping. Triple sulfonamides in gram doses were given every four hours. The ulcer improved (fig. 4) and by September 10th was healed. He returned to work October 5th with a final visual acuity of 20/25 in this eye.

Fig. 3 (Cassady). Case 29,695 D. A., pseudomonas corneal ulcer, September 4th O.D.

CASE A29,647

L. R. was seen on September 2nd with a history of having a corneal foreign body removed from his left eye August 30th. On the cornea there was a deep gray ulcer with superficial necrosis. Culture showed Pseudomonas and Staphylococcus sensitive to polymyxin B and terramycin. The patient was a diabetic whose fasting blood sugar was 148. Hospitalized, he was treated with triple sulfonamide and intravenous typhoid, together with local instillations of polymyxin hourly in neosporin ophthalmic solution and polysporin ophthalmic ointment. He was hospitalized till September 10th but the ulcer was not entirely healed until September 26th. His final corrected visual acuity was 20/40 in this eye.

CASE A30,410

F. C., aged 56 years, was seen on September 24th with the history of having a corneal foreign body removed from his right eye three days previously. His eye had been inflamed during the past 24 hours. A grayish white corneal ulcer extended from the limbus to the center of the cornea (fig. 5). There was wrinkling of Descemet's membrane and the surface of the corneal ulcer was necrotic. Culture showed Pseudomonas moderately sensitive to polymyxin B. After hospitalization, Chloromycetin (one gm.) was given every eight hours. Polymyxin B in 50-mg. doses was administered four times daily. Local instillations of Neosporin ophthalmic solution and Polysporin ophthalmic ointment were used. After a few days, the Chloromycetin and polymyxin B were discontinued and triple sulfonamides in gram doses were started. On September 30th, he was discharged from the hospital and by October 5th the ulcer was healed. He returned to work October 22nd with a final visual acuity of 20/30 in this eye.

CASE 6,328-56

J. D., a Negro aged 35 years, was seen on November 3rd with a history of removal of a corneal foreign body from his left eye 48 hours previously. There was a grayish green ulcer of the lower one-half of his cornea. Culture yielded a growth of Pseudomonas, slightly sensitive to streptomycin, aureomycin, polymyxin B and tetracycline. Before the sensitivity tests were reported, the ulcer was improving in the hospital with systemic and local polymyxin. When the culture was reported the systemic polymyxin was discontinued and triple sulfonamides were started. The ulcer was healed by November 23rd and he returned to work December 3rd. The final visual acuity was only 20/200 because of the central location of the superficial opacity.

CASE 32,065

H. G., aged 40 years, was seen on November 9th with a grayish white corneal ulcer in his right eye. He had had corneal foreign bodies removed 48 hours earlier from both eyes. Homatropine had been used in the right eye only. Otherwise a spud and pontocaine were used in each eye. The left eye appeared normal but on the right cornea there was a necrotic ulcer about two mm. in diameter (Fig. 6). He was not hospitalized but sent home with Neosporin ophthalmic solution and atropine solution for local instillations. The following day, the ulcer was much larger, with iritis and marked chemosis of

Fig. 4 (Cassady). Same case, September 8th.

Fig. 5 (Cassady). Case A30,410. F. C., pseudomonas corneal ulcer, September 24th, O.D.

the bulbar conjunctiva. The culture that was taken November 9th showed Pseudomonas.

Hospitalized, he was given polymyxin B intramuscularly in 50 mg. doses every six hours and oral Chloromycetin in gram doses every eight hours. This was in addition to the use of polymyxin locally in drop and ointment form. When he was discharged on December 3rd, the ulcer appeared to be healing but on December 10th it was necessary to rehospitalize him because of recurrence of the ulcer with hypopyon. At this time culture showed no organisms but Polymyxin was used again and by December 18th the ulcer was healed. His final visual acuity was 20/80 in this eye.

CASE A32,064

A. H. V., aged 40 years, was seen on November 9th with the history of having a foreign body removed from his left cornea two days previously; the pupil was dilated with homatropine at that time. A grayish ulcer surrounding a ring of rust was present in his left cornea. Culture showed Pseudomonas moderately sensitive to streptomycin and polymyxin B. After removal of the rust, he was treated at home with atropine, Neosporin solution and Polysporin ointment till the following day, November 10th, when the ulcer was larger and the eye more inflamed (Fig. 7). Hospitalized, he was treated with Polymyxin locally and systematically. The ulcer was healed by November 30th and he returned to work December 3rd. His final visual acuity was 20/20, the corneal opacity not being in the pupillary area.

CASE A33,270

E. Z., aged 42 years, on December 18th gave the history of the removal of a corneal foreign body from his left eye December 14th. There was a deep grayish white ulcer of the left cornea (Fig. 8). Culture showed Pseudomonas, moderately sensitive to polymyxin B and terramycin. Hospitalized, he was

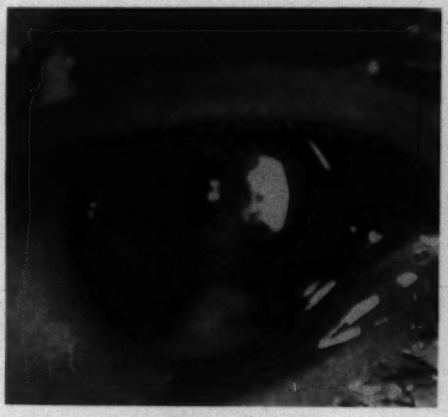

Fig. 6 (Cassady). Case 32065, H. G., pseudomonas corneal ulcer, November 9th, O.D.

Fig. 7 (Cassady). Case A32,064. A. H. V., pseudomonas corneal ulcer, November 10th, O.S.

treated locally and systemically with polymyxin B. He was discharged December 22nd. His final visual acuity was 20/30 in this eye.

CASE 36,506

F. S., aged 54 years, was seen on March 29th with a history of having a foreign body removed from his cornea three days previously. There was a deep corneal ulcer with necrotic surface and wrinkling of Descemet's membrane. Culture showed Pseudomonas moderately sensitive to polymyxin B and streptomycin. Because of an associated hypopyon, subconjunctival polymyxin B was given at once and in the hospital on the following day. Polymyxin instillations and Neosporin ophthalmic solution were used hourly together with atropine. On April 6th he was discharged from the hospital; and the ulcer was healed by April 15th. His final visual acuity in this eye was 20/30.

CASE A33,360

J. W., aged 47 years, had a corneal ulcer of the right eye following removal of a foreign body a few days previously. It was a large ulcer, necrotic

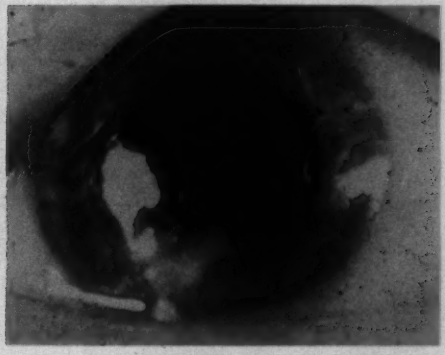

Fig. 8 (Cassady). Case A33,270. E. Z., pseudomonas corneal ulcer, December 18th, O.S.

and penetrating. Culture showed Pseudomonas moderately sensitive to polymyxin and streptomycin. Hospitalized, he was treated with polymyxin B intramuscularly in 50 mg. doses four times daily, as well as Neosporin and Polysporin locally. After four days, December 14th to 18th, the ulcer was healing. After discharge from the hospital, however, it flared up again and he was re-admitted (December 21st) and subconjunctival polymyxin was instilled daily without systemic medication. The ulcer responded to treatment and he was discharged December 29th. His final visual acuity was 20/40. (Subconjunctival polymyxin B sulfate is given in 10,000 u. doses in 0.5 cc. procaine with adrenalin.)

Discussion

Treatment of these 10 patients with Pseudomonas corneal ulceration was more empiric than scientific. Sensitivity tests were not strictly followed because 48 hours elapsed from the hour of culture to the time of report and, if the ulceration was responding, the visible clinical improvement did not justify a change in therapy.

Pseudomonas ulceration of the cornea is such a severe and destructive disease that, when two of the 10 patients became worse on local ocular instillations only, systemic polymyxin seemed necessary to halt the corneal ulceration. The use of Chloromycetin in gram doses every eight hours was based on the knowledge that the eye would absorb Chloromycetin better than other antibiotics and if the infection should prove not to be Pseudomonas, Chloromycetin was the most effective ocular antibiotic.

The use of systemic sulfonamides was also empiric since they are believed to be effective chemotherapeutic agents against streptococcus, pneumococcus and staphylococcus which so often are secondary invaders after Pseudomonas is controlled.

In retrospect, the entire group of patients could have been best managed with subconjunctival rather than systemic polymyxin. However, until the identity of the organism was certain, relying on such treatment did not seem to be justified. If additional patients are encountered, Polymyxin B subconjunctivally will be the treatment of choice.

Although some of these eyes with Pseudomonas corneal ulcer did not retain normal vision, no eyes were lost, no corneas perforated, and the corneal infection was arrested in every instance. In my earlier experience with Pseudomonas infections of the cornea, the reverse was true. Although, occasionally, the globe was saved, in almost every instance the cornea was so scarred as to render the eye useless except as a cosmetic aid in moving a shell. The arrest of Pseudomonas infection of the cornea must be attributed to the antibiotic polymyxin B.

Whether local treatment without systemic polymyxin would have been as effective cannot be proved. The two patients with Pseudomonas corneal ulcer treated with subconjunctival polymyxin B together with conjunctival instillations responded as well without systemic Polymyxin. Their improvement and hospital stay and final visual acuity suggest that such treatment is adequate without intramuscular injections of polymyxin B.

Why Pseudomonas infections of the cornea occur in some individuals but not in others with apparently equal exposure and inoculation may be due to the resistance of the individual more than to the virulence of the organism. It was true in experimental animals that some few corneas were infected but more were not when exposed to the same inoculum. It was also shown that there was a relationship between the antibodies and agglutinins of the host and its resistance to infection. The severe ulceration of the cornea with Pseudomonas infection continued even though Pseudomonas was controlled by polymyxin. The polymyxin treatment needed to be enhanced after the Pseudomonas infection was controlled by antibiotics that would inhibit other organisms from causing further ulceration.

The best treatment of Pseudomonas ulceration of the cornea is prevention, the next best is early recognition of this type of corneal ulceration, together with vigorous measures to combat the infection. In these cases, polymyxin B has been effective as an antibiotic and, whether it was used systemically,

locally, or subconjunctivally, it did not create systemic or renal toxicity, nor were neurologic signs encountered. Of course, systemic, intramuscular, or subconjunctival injections of polymyxin B were used only a few days. The systemic dosage of 2.5 mg. per kg. of weight is believed to produce an effective therapeutic level approximately 30 minutes after injection, its peak two hours later. After six hours, the peak level is reduced one half so its use four times a day seemed necessary to control the Pseudomonas infection. If systemic, renal, or neurologic symptoms of toxicity do appear, they disappear within 48 hours after the drug is discontinued.

Summary

Experience with Pseudomonas inoculations of the cornea of rabbits revealed that infection was limited to only a small percentage of those inoculated. Infection of the cornea was dependent upon the presence of antibodies to the Pseudomonas organism or to its proteolytic enzyme.

Patients with Pseudomonas ulceration of the cornea are successfully managed with polymyxin provided the antibiotic is used before the corneal ulceration has progressed too extensively. After Pseudomonas seems to disappear from the eye, the proteolytic enzyme or secondary infection can cause further ulceration. It is necessary in management of Pseudomonas corneal ulcers to start treatment early and to guard against progress of the ulceration after Pseudomonas organisms have been controlled.

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RETAINED GLASS FOREIGN BODIES IN THE ANTERIOR CHAMBER*

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Recurrent bullous keratitis, or iridocyclitis, can be due to retained particles of glass in the anterior chamber. In many instances, following an accident involving the patient's glasses, particles can be seen in the cornea, anterior chamber, or suspected in the posterior segment. Glass is relatively inert, and small particles may remain dormant in the cornea for years. Sometimes these small slivers may migrate forward and extrude spontaneously, or they may have to be removed. Small particles of glass may, however, penetrate the cornea and lie dormant for some time before causing symptoms. In most instances, the only way they can be detected is by careful slitlamp examination and gonioscopy.

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Radiologic demonstration of glass foreign bodies is, in most instances, unsatisfactory. Zwanger,[1] et al. state that the detection of glass foreign bodies by X-ray examination depends on their size, radio opacity, and position. They recommend the nose chin, posterior-anterior Waters projection for detecting posterior segment intraocular foreign bodies, and tangential bone free films for anterior segment foreign bodies. Roberts[2] feels that these bone free roentgenograms can demonstrate most glass foreign bodies of the anterior segment if they are taken at various angles and penetrations, and processed in an identical manner.

Moskovitz[3] feels that "the most definite means of demonstrating a chamber angle foreign body is by gonioscopy" and in three of our cases, this was the only method by which the foreign body could be detected.

In a survey of the literature of the past five years, there are only four reported cases of retained glass foreign bodies.[3-6] Doherty's[4] case was asymptomatic for one and a half years following his original injury, and then developed pain, blurred vision, photophobia, and lacrimation—which symptoms persisted for one year. When seen by Doherty, "the cornea presented a large vascularized infiltration, and was a textbook picture of bullous keratitis." A piece of glass was found in the anterior chamber angle. Summers'[5] case was asymptomatic for six months, and then developed irritation, interstitial corneal haze with bedewing. These symptoms disappeared when the glass in the anterior chamber was removed. Nicolas[6] reports an unusual case of a glass foreign body manifesting itself by corneal edema and lens opacity, without an obvious penetrating wound. These cases all had in common corneal edema, with a subsequent visual disturbance. Moskovitz[3] reports a case of a retained glass foreign body characterized by recurrent episodes of acute iridocyclitis.

Case reports

We are reporting four cases of retained glass in the anterior chamber (seen in a two and a half year period) that were successfully operated upon. All of our cases had recurrent corneal edema, and one had a recurrent iridocyclitis.*

Case 1

A. P., a 27-year-old man, whose goggles were shattered by a flying piece of steel in July, 1954. Superficial splinters were removed at the plant dispensary, and in another ophthalmologist's office following the accident. A few small pieces were allowed to remain in the substantia propia, and one deeper on Descemet's membrane. The patient was free of symptoms for one year, when ulceration and edema were noted over the corneal scar. Symptoms were recurrent for several weeks before he was seen in our office in July, 1955. At that time, the vision was 6/21 in the involved eye. In the lower nasal quadrant there was the old corneal scar, with surrounding edema. Two small spicules of glass were seen in the substantia propia, and another piece was seen projecting through the endothelium into the anterior chamber. The foreign body was removed from the posterior surface of the cornea following a hemisection at the limbus, and folding the cornea over to expose the glass. The post-operative course was uneventful, there has been no subsequent edema, and the patient, three years later, had maintained 20/25 vision.

Case 2

A 29-year-old man, who was injured in an explosion in 1944. Multiple foreign bodies were removed from the right cornea (one protruded into the anterior chamber) shortly after the accident. The corneal wound healed, and the eye was asymptomatic for six months. The cornea then became hazed, due to epithelial edema, and bullae were noted below the site of the penetrating wound. Several consultants saw the patient, and one of them stated "the mechanism of the bullous keratitis was a loss of endothelium which permits the cornea to imbibe aqueous"—but no suggestion was made as to the possible etiology. This condition was recurrent for over 12 years before the patient was seen in our office on October 31, 1956. Examination revealed the vision to be corrected to 20/30. The eye was injected, and there was considerable corneal edema between the 5- and 7-o'clock position. Gonioscopy revealed a small fragment of glass in the angle at the 6-o'clock position. This was removed, and for the first time in 12 years, the patient has been asymptomatic. The last examination revealed the vision to be correctible to 20/20. There was slight hazing of the cornea below, but the cornea was completely smooth, and there was no edema.

* Even though the glass was visible in all four cases, radiologic examination failed to confirm its presence.

CASE 3

A 13-year-old boy was injured when a medicine dropper, in which he had placed some gunpowder, exploded. He was treated for a corneal abrasion, but three weeks later the eye became injected, and blurred vision was noted. He was seen by another physician, who felt that he had an intraocular foreign body, and referred him to us. When seen by us, the vision was 20/60, the conjunctiva was injected, and a healed through and through corneal laceration was seen in the upper temporal quadrant. There was considerable bedewing and corneal edema at the limbus in the 7-o'clock meridian. Gonioscopy revealed a sliver of glass in the angle underlying the corneal edema. This was removed, and the eye showed a minimal postoperative reaction. One month later, the cornea was completely quiet, there was no edema, and the patient's corrected vision was 20/20—2.

CASE 4

G. D., a 38-year-old man, whose face was severely injured in an automobile accident in 1949. His right cornea was lacerated (with iris prolapse) requiring an iridectomy and several sutures. Both nasolacrimal ducts were completely severed. When first seen in our office, in 1954, the vision in the right eye was corrected to 6/21, and there was a pannus covering the cornea from the 10- to 2-o'clock positions. Both cul-de-sacs were filled with purulent secretion from a bilateral dacryocystitis. A bilateral dacryocystorhinostomy was performed, and the patient was sent back to his local ophthalmologist. The patient was referred back to us in 1957 with a continuing dacryocystitis on the right side. There was a mild iridocyclitis with some hazing of the cornea on that side, and the pannus as noted three years previously. The vision at this time was limited to counting fingers. It was felt that the patient had a keratoconjunctivitis, due to his purulent dacryocystitis. Another dacryocystorhinostomy was performed, which appeared to be successful. While convalescing from this procedure, a gonioscopic examination revealed a fairly large sliver of glass in the angle at the 12-o'clock position, in the area where the iridectomy had been performed. Despite the fact that the glass had lain in contact with the lens for eight years, there was no evidence of a cataract. The glass was subsequently removed without difficulty.

DISCUSSION

It is well known that glass is inert, and small particles may remain in the cornea or conjunctiva for years without symptoms. However, when it is in contact with the endothelium, the particle of glass gives rise to a classic symptomatology of photophobia, blurred vision, and localized corneal edema. When this occurs, with the history of an accident, one should carefully examine the anterior segment with a gonioscope. Cases 2 and 4 demonstrate clearly that there may be a remission of symptoms, and how readily one may miss the true diagnosis—especially if there are other complicating factors.

Once the diagnosis of glass in contact with corneal endothelium is made, the glass should be removed. The surgical procedure is not difficult, providing it is approached in the right manner. It must be remembered that small splinters of glass are difficult to pick up with forceps, and because of their edges and varying shapes, they cannot be pulled through a small opening.

A limbus based conjunctival flap of two to three mm. is prepared for 150 degrees to 180 degrees of the circumference. Two preplaced corneal sutures are prepared on either side of the foreign body, and the anterior chamber entered by a scratch incision, or with a keratome in one of the grooves. A corneal scleral section of 140 to 160 degrees is then made. One must be careful not to irrigate the chamber, and not to wipe vigorously with a swab. Once the section is complete, the cornea should be folded back, the glass identified in the angle, and then removed with forceps. Following this, the chamber may be irrigated, and the incision closed. We feel that most of the difficulty that may be encountered is due to an inadequate section. The section should be large enough so that the cornea can be elevated and folded if necessary, to permit the operator to view the angle from the directly opposing meridian, that is, if the foreign body is at the 6-o'clock position and the corneal section from the 3:30 to 8:30-o'clock positions, the surgeon may have to stand to the side (or at the 12-o'clock meridian) to see into the angle. Though an operating microscope was not available when this surgery was performed, it might prove to be of considerable value. The foreign bodies are much smaller than they appear with a gonioscope, and a loupe or some type of magnification is necessary to identify them.

Case 2 also presents another interesting problem. This patient's accident occurred at work. He received some compensation benefits but the statute of limitations was long passed by the time the true diagnosis was made. Fortunately, the company saw fit to pay his expenses, though they were not obliged to do so. With the increasing tendency to seek legal aid, it behooves all of us to rule out the presence of glass in the anterior chamber in every patient who suffers an accident in which glass is involved. It is our opinion that if the fragment of glass is in contact with the endothelium, it should be removed—even if the eye is free of symptoms at the time of discovery.

This, of course, poses the problem as to when should a recognizable glass foreign body be left undisturbed. One cannot be dogmatic, but we would suggest that small particles in the substantia propria of the cornea be observed and no attempt be made to remove them unless they cause symptoms.

A small sliver on the iris, or in the angle which is barely recognizable with the slitlamp or gonioscope, might also be followed unless it causes symptoms. The attempted removal of asymptomatic minute particles may cause unnecessary damage to the eye. Glass is extremely difficult to see without the higher powers of magnification available with the slitlamp. In the presence of asymptomatic particles in the cornea, sclera or conjunctiva, it has been our practice to note it on the record, and to tell the patient these are present and in all probability will not cause any further damage. We have never observed an asymptomatic particle in the anterior chamber. Should one be present and not in contact with the endothelium and of the size that might prove difficult to ensure its removal, we would likewise advise the patient of its presence, but suggest periodic observation. The problem of its removal would then be a matter of surgical judgment and not of neglect in its recognition. There is a certain element of risk in any surgical procedure, and knowing that glass is relatively inert, the problem of removing a minute sliver might outweight the risk of leaving it alone. We do not feel that delay in removal of the foreign body, with the exception of Case 4, had any bearing on the final visual result.

Summary

Retained particles of glass in contact with the corneal endothelium cause photophobia and blurred vision. Examination reveals corneal edema which may resemble bullous keratitis, and there may be an accompanying mild iridocyclitis. Four cases are reported in which the glass was unrecognized in the anterior chamber for periods ranging from four weeks to 12 years.

Surgical removal is mandatory if the glass is in contact with the endothelium. It requires a wide corneal section, so that the cornea can be folded on itself in order that the base of the iris and angle can be visualized directly. Minute particles in the cornea, sclera, conjunctiva, or on the iris which are asymptomatic should be observed and removed only when causing symptoms.

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STRABISMUS FIXUS*

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In his classic text-book Duke-Elder[1] gives the following description of strabismus fixus under the heading of congenital strabismus fixus:

"A congenital strabismus having the characteristics of an anomalous retraction syndrome is due to the presence of a rigid, fibrous, short internal rectus intimately attached by a broad fibrous area to the sclera near the equator. This more or less fixes the eye in a position of adduction with complete loss of abduction." The photograph shown by Duke-Elder was taken from an article written by Bielschowsky.

In his lectures on *Motor Anomalies* Bielschowsky[2] refers to strabismus fixus when he discusses the subject of "congenital deficiencies of abduction." He states that the majority of the cases of Duane's retraction syndrome are due to the lateral rectus being replaced by a nonelastic fibrous band. In some instances, however, the lateral rectus is normal and the medial rectus forms a nonelastic band which prevents both active and passive abduction of the eye.

Bielschowsky seems to consider strabismus fixus as a variety of Duane's retraction syndrome when he states:

"There is a striking contrast between the unilateral total lack of abduction (in Duane's retraction syndrome) and the very small paralytic deviation which, in many cases, is hardly noticeable even when the head and gaze are in the primary position. Only exceptionally, one meets with extremely high deviations due either to a maximal contracture of the internal rectus, or to the presence of abnormal fibrous tissue in the place of that muscle fixing the eye in a strongly adverted position (fig. 27)."

The legend of Figure 27 (which is the same photograph that Duke-Elder reproduces in his textbook) reads: "Extremely high deviation in a case of bilateral congenital deficiency of abduction due to abnormal tissue in place of the internal recti muscles."

Bielschowsky emphasizes that, in the usual case of retraction syndrome, the paralytic deviation is very small, which contrasts with the enormous deviation of strabismus fixus. Nevertheless, he seems to consider strabismus fixus as a variety of the rarer second anatomic type of retraction syndrome, that is, the one which is due to an inextensible medial rectus instead of the (more common) abnormality of the external rectus.

Before this, Aebli[3] also related strabismus fixus to Duane's retraction syndrome. In his Case 5, with a typical bilateral retraction syndrome, he found at operation that the restricted abduction was due to a rigid, fibrous, short internal rectus intimately attached to the globe at the equator. On the other hand the lateral rectus contained considerable muscle tissue and little fibrous tissue. For this reason he catalogued this case as strabismus fixus and not as a real retraction syndrome. As a matter of fact this case is a genuine Duane's retraction syndrome, as shown by the photographs in Aebli's paper but it belongs to the second anatomic variety (due to an abnormality of the medial rectus) later described by Bielschowsky.

On the other hand, Case 6 in Aebli's paper is a true strabismus fixus (although he considers it as an intermediate case between a retraction syndrome and strabismus fixus), as it deals with a patient with a "marked left esotropia with the eyes in the primary position, with complete loss of abduction in the left eye, the eye being fixed in the nasal field and not coming out to the midline." At operation he found a rigid fibrous internal rectus intimately attached to the globe near the equator and the external rectus replaced by

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a thin fibrous band containing no muscle tissue.

Scobee[4] has a short paragraph on strabismus fixus which states: "Strabismus fixus is a condition wherein the medial rectus is found to be replaced by fibrous tissue and, for that reason, is quite inelastic. The globe which has such a medial rectus is usually permanently in a position of marked adduction. Occasionally, however, the fibrous change in the medial rectus is not complete and some degree of abduction is permitted; the case may then be easily mistaken for one of the retraction syndrome of Duane. At operation the lateral rectus of such a case may be thin and atrophic while the medial rectus is usually tough and fibrous with little or no muscular tissue visible."

In the chapter on congenital structural muscle anomalies of the *Strabismus Ophthalmic Symposium I,* Brown[5] states: "Strabismus fixus as the term is used here will be limited to a congenital anomaly in which the eye is 'anchored' in the position of adduction by a thick fibrous band that apparently has replaced the internus. The scleral insertion of this band is well posterior to the normal insertion of the internus." Eight years later the same definition is given by this author in *Strabismus Ophthalmic Symposium II.*[6]

Although the authors just quoted agree on strabismus fixus being a congenital anomaly due to a structural alteration (fibrosis) of the medial rectus, the purpose of my paper is to demonstrate the contrary—that the shortness and fibrosis of the medial rectus is only a consequence (secondary contracture) of the primary paralysis of the lateral recti.

To substantiate my belief, I will show a typical case of strabismus fixus that was acquired at the age of 20 years, after a severe cephalic traumatism with a probable fracture of the base of the skull, and two congenital cases in which the fixity of the strabismus disappeared (Case 2) or diminished greatly (Case 3) with alternate occlusion, which apparently had the effect of relaxing the secondary spasm of the medial recti.

As far as I know the only author who has expressed a somewhat similar thought is Epstein,[7] who states under the heading of strabismus fixus: "An alternating concomitant convergent strabismus may arise as a result of congenital bilateral lateral rectus paralysis or paresis, a rare lesion. In such a case, the patient may elect to fix only with the right eye in levoversion and only with the left eye in dextroversion. This manner of fixation makes for minimum movement of either eye, and has therefore been termed strabismus fixus. The same term has been applied to an even more rare lesion—a congenital fibrosis of both medial recti which holds both eyes fixed in an adduction which is sometimes extreme (Bielschowsky)."

In a review of the literature from 1930 to date I have found only one article about strabismus fixus. It is the case report of Martinez[8] of a Mexican farmer, aged 60 years, who developed a marked bilateral convergent strabismus fixus after the age of 30 years. This case was therefore not congenital but acquired in adult life. He does not give details about the beginning of the trouble or its causes, only mentioning that there had been slow and progressive increase of the deformity to the point of complete incapacity for work. Recession of the medial recti and resection of the lateral recti (Blaskovics' technique) gave a very good immediate result. Martinez found at operation that the medial rectus behaved like a fibrous, inextensible, extremely short and tense band, while the lateral rectus gave the impression of being narrowed and slender, and extremely flaccid.

Case reports

Case 1

M. P., a 36-year-old man, was first seen in April, 1957. During his childhood and adolescence his eyes had been straight, as shown in pictures from his family album (fig. 1). At the age of 20 years, he suffered a violent blow to the head in an automobile accident. He remained unconscious during 24 hours and bled through the ears, mouth, and nose. Thereafter, he developed a marked convergent strabismus. Eight years later he had an inflamma-

Fig. 1 (Villaseca). Patient with straight eyes at the age of six months and 14 years.

tion of the left eye, which resulted in a corneal leukoma. The patient presented a feminine countenance and was partially deaf.

The ocular examination showed a striking bilateral convergent strabismus fixus, the most pronounced that I have ever seen (fig. 2-b). The patient fixed with the right eye by rotating the head forcibly to the right and looking over the bridge of his nose. The strabismus was estimated at about 45 degrees for his right eye and about 70 degrees for his left eye, that is to say a total of about 115 arc degrees.

In Figure 2-a (with adhesive tape over the right eyebrow) the patient is trying to look to his right, and in Figure 2-c (with adhesive tape over the left eyebrow) he is trying to look to his left. It can be seen that the left eye is completely frozen and that the right eye is only able to adduct about 10 degrees.

Vision was: O.D., 20/30; O.S., counting fingers at 30 cm. (later when this eye could fix with the macula, after being surgically straightened, the real vision of 10/80 could be measured).

The cornea of the left eye presented superficial leukomas which obscured the central area.

When planning the operation of O.S. it was realized that a recession of 5.0 mm. of the medial rectus would not enable rotation of the eye to the primary position. One possibility was to do a free tenotomy of the medial rectus combined with a resection of the lateral rectus. It was decided to make a variant of a guarded tenotomy in the medial rectus, lengthening this muscle with a long bridle of nonabsorbable Supramid. As the eye was practically fixed to the caruncle, it was thought that a free graft of conjunctiva should also be brought to the medial canthus to free the eye.

On April 15, 1957, the left eye was operated under local anesthesia. It was very difficult to reach the medial rectus as the eye could only be slightly rotated out with forceps from its position of extreme convergence. A Supramid suture was painstakingly placed in the inferior third of the tendon and another in its superior third; each suture was tied with a double knot before sectioning the tendon flush with the sclera. After this the eye could rotate freely outward.

The following procedure was done to fix the bridle at the tendon stump and to avoid the possibility of its sliding forward postoperatively. In each double-armed suture one needle was inserted in the tendon stump from behind onward, as usual, and the other from the front backward (fig. 3-A). The end of the thread *a* was then introduced beneath the central thread (fig. 3-B) and the end of the thread *b* was passed beneath the other three threads in the opposite direction (fig. 3-C), fastening both ends with a triple knot (fig. 3-D). In this manner the double bridle remained fixed in one end of the tendon stump and had a definite length. At the other edge the same procedure was done with the second bridle.

Before tying the sutures the eye was rotated outward with forceps until the outer limbus reached the level of the lateral canthus, in order to estimate the proper length of the bridle sutures, which was nine mm. These were then put taut and tied with a triple knot. The lateral rectus was then resected 12.5 mm.

The edges of the medial conjunctival incision were then brought in contact with forceps and this proved that, after suturing, the eye would be left in a convergent position due to the scarcity of bulbar conjunctiva at this level. A rectangular flap was then cut in the lateral bulbar conjunctiva, having the length of the conjunctival incision at the lateral rectus muscle and a width of four mm. toward the limbus (fig. 4-a). This was grafted on to the medial conjunctival incision, as shown in the photograph (fig. 4-b) taken some days later.

The same operation was done in O.D. nine days

Fig. 2 (Villaseca). The same patient with strabismus fixus at the age of 36 years. On trying to look to the right (a) or left (b), there is no movement of abduction. Slight adduction of O.D. (c).

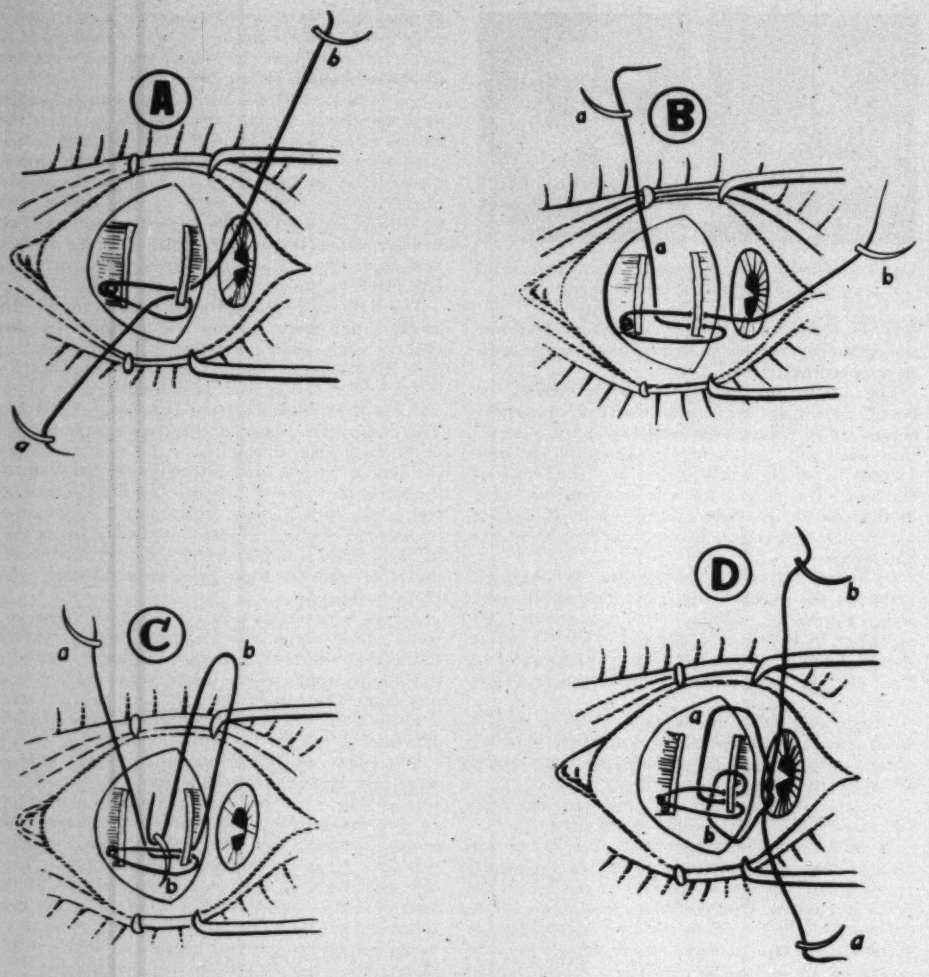

Fig. 3 (Villaseca). Anchoring the Supramid bridle sutures to the sclera. (A) Needle (b) is inserted in the tendon stump from behind onward and needle (a) from front backward. (B) Needle (a) passes beneath thread (b). (C) Needle (b) passes under the three threads. (D) After the knot is tied, the bridle cannot slide forward.

later. In this eye the Supramid bridles in the medial rectus were given a length of seven mm. and the lateral rectus was resected 11 mm. Most of the lateral bulbar conjunctiva was also grafted on the medial side. Only a 2.5 mm. band of conjunctiva was left attached to the external limbus and a similar one to the posterior lip of the lateral conjunctival incision, so as to be able to suture this wound. In both eyes the lateral rectus muscles were found not to be atrophic, as would be expected, but had a normal fleshy appearance.

The photographs (fig. 5) show the immediate result 12 days after the second operation. As can be seen, O.D. is in the primary position and O.S. about 25 degrees convergent.

In Figure 5-a (looking to the right) a very slight movement of abduction of O.D. and a slight adduction of O.S. are noted. In Figure 5-c (looking to the left) no movement of abduction of O.S. is noted, but there is a moderately good capacity of adduction of O.D.

The fundus was normal, O.U. Vision was: O.D., 20/25, with a 1.0D cyl. ax. 0°. O.S., 10/80 + with a −3.0D. sph. ⌒ −3.0D. cyl. ax. 0°

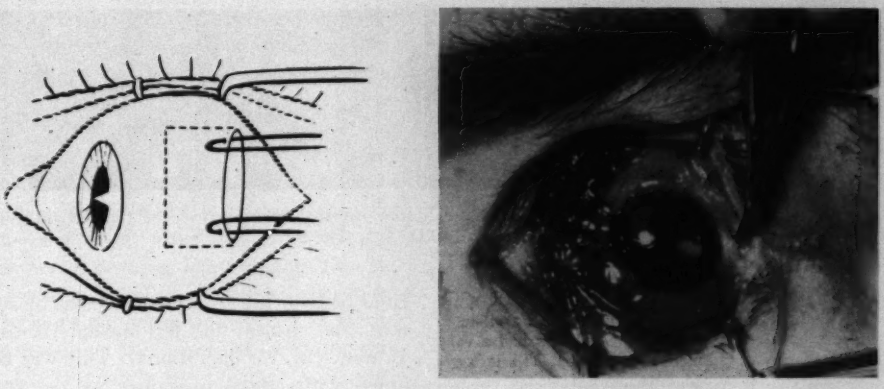

Fig. 4 (Villaseca). Rectangular flap of bulbar conjunctiva grafted from the outer to the inner side.

Four months later the convergent strabismus, O.S., had increased to about 40 degrees (fig. 6-b). The capacity of adduction, O.D., was very good (fig. 6-c), which probably meant a good performance of the bridle suture placed in the right medial rectus. O.S. remained in its frozen position. Supraversion and infraversion were normal, O.U. A movement of convergence of about 10 degrees could be elicited, O.D. (fig. 6-d).

It was not possible to measure the deviation with prisms due to the lack of movement, O.S. On the synoptophore the objective angle was of approximately +45 arc degrees.

On August 23, 1957, O.S. was reoperated under local anesthesia. O.D. could be abducted 15 degrees beyond the middle with forceps and O.S. just to the midline. The left medial rectus was explored. The upper Supramid bridle had no adherence to the soft overlying tissues and a few frail ones to the sclera. The lower bridle suture was slightly adherent to Tenon's capsule on its surface and firmly adherent to the sclera through its under face. The anterior edge of the muscle was also adherent to the sclera in its new recessed position.

After freeing the adherences, the bridle sutures were lengthened seven mm., with new pieces of Supramid fastened to the end of the old bridles, until they reached a total length of 16 mm. Unfortunately no Gelfilm was available to wrap the bridles so as to prevent the formation of new adhesions.

Following this a six mm. new (second) resection of the left lateral rectus was done, the maximum that could be achieved. Since, at the first operation, 12.5 mm. of this muscle had been resected, a total of 18.5 mm. of resection was completed. It should be kept in mind that this muscle had undergone an abnormal stretching for 16 years.

As the bulbar conjunctiva at the medial canthus was still judged to be short, the operation was finished by placing another free graft of conjunctiva in the medial wound, using this time a piece of conjunctiva (12 by 4.0 mm.) taken from the upper fornix of the same eye.

The operated eye was straight for a week and then began to converge gradually. A fortnight after the operation O.S. was 15 degrees convergent and could move between +5.0 and +20 degrees. With forceps this eye could be abducted five to 10 degrees beyond the midline, whereas the right eye could be passively abducted about 20 degrees and adducted to the medial canthus.

Eight months after the last operation (April, 1958) the patient had a residual convergent strabis-

Fig. 5 (Villaseca). Immediate result after surgery, O.U. Slight abduction, O.D., (a) and good adduction of the same eye (c). Slight adduction, O.S. (b).

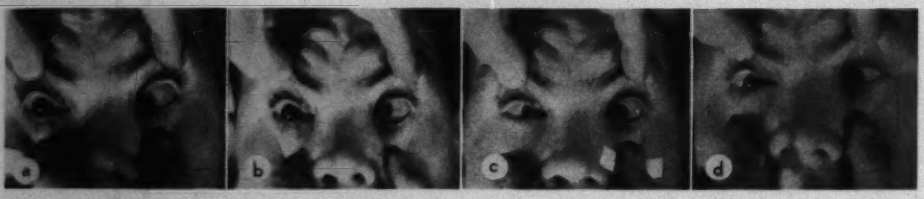

Fig. 6 (Villaseca). Same patient as in Figure 5 four months later. Increase of the deviation, O.S., to about 40 degrees (b). Very good adduction, O.D. (c). The left eye is frozen (a, c). Convergence movement of 10 degrees, O.D. (d).

mus, O.S., of about 20 degrees when looking straight ahead (fig. 7-b and d). The right eye was able to abduct about five degrees (fig. 7-a) and had a very good capacity of adduction (fig. 7-c). The left eye could barely be moved outward a few degrees and could adduct about 10 degrees (fig. 7-a). Elevation and depression were normal, O.U. A movement of convergence of about 10 degrees was present, O.D.

On the synoptophore there was simultaneous perception and fusion at +29° I/D 14Δ, with the large figures. There was supression, O.S., with the smaller figures.

Fortunately the patient did not suffer from diplopia because of the amblyopia, O.S.

Discussion

In this case the strabismus fixus was acquired in adult life after suffering a severe cephalic traumatism, with a very likely fracture of the base of the skull (otorrhagia). It is highly probable that there was a paralysis of both lateral recti with secondary spasm of the medial recti, and that their later contracture provoked the fixed strabismus.

The degree of strabismus was so great (45 degrees, O.D.; 70 degrees, O.S.: total 115 arc degrees) that a special operation had to be devised to provide enough elongation of the medial recti to mobilize the eye to the primary position. It consisted in placing Supramid bridles which prolonged the muscular body of the right medial rectus by seven mm. and that of the left medial rectus by 16 mm. (in two operations). This was combined with ample resections of the lateral recti: 11 mm., O.D.; 18.5 mm., O.S. (in two operations). Bulbar conjunctiva was also transplanted to the inner angle. In spite of all this there remained a residual convergent strabismus, O.S., of 20 degrees.

The resulting lateroversion movements were: Slight abduction, O.D., and no abduction, O.S. Very good adduction, O.D., and slight adduction, O.S.

The lack of abduction is partly explained by the bilateral traumatic paralysis of the VIth nerve, and partly due to the passive limitation produced by shortage of the tissues at the medial canthus, the conjunctiva included.

The normal movement of adduction, O.D., can be explained either by the direct pull of the muscle on the sclera (at a new insertion about seven mm. behind its normal place) or through indirect traction transmitted to the normal scleral insertion by the seven-mm. Supramid bridle. As this eye was not explored surgically a second time, it is not

Fig. 7 (Villaseca). Same patient as in Figures 5 and 6 eight months after surgery, showing the final result (b and d). Slight abduction, O.D. (a) and very good adduction of the same eye (c). Slight adduction, O.S. (a).

known whether there was a reinsertion of the muscle in the sclera or if the bridles acted freely. The minimum adduction, O.S., (about 10 degrees) is probably effected through an indirect pull transmitted by the 16-mm. long Supramid bridle, as a possible reinsertion of the muscle in the sclera so far back would not adduct the eyeball but retract it into the orbit.

Another interesting feature about this patient is the fact that at operation both lateral recti were found not to be atrophic, as would be expected, but had a normal fleshy appearance. Unfortunately the fragments of muscle that were reserted were not kept for histologic examination. There can be little doubt that a strabismus appearing in an adult, and particularly after a severe trauma to the head, is paralytic. Yet after 16 years with complete lack of abduction (fixed convergent position) the lateral recti did not appear to be atrophic.

It is rather surprising that histopathologic studies of paralytic extraocular muscles have not been reported, as far as I know. Experimental work seems also to be lacking in this field, and it is hoped that this report will stimulate these investigations. This case would suggest the following basic questions:

1. Are there differences between the behavior of a skeletal and an extraocular muscle after section of their motor nerves?

2. Could the stretch reflex* (produced by the spasm and/or contracture of the homolateral antagonist) explain the lack of atrophy of a paralytic extraocular muscle?

The following case reports are of congenital strabismus fixus, and therefore the examination of these infants could not be very complete.

CASE 2

R. C., a nine-month-old boy, was first seen in April, 1952. A convergent strabismus of both eyes had been noted by his parents since birth. There was no hereditary history of strabismus and both the pregnancy and childbirth had been normal.

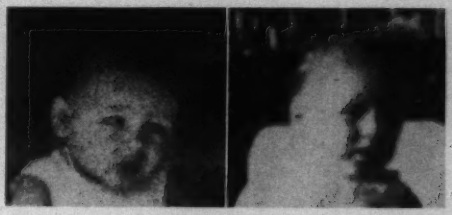

Fig. 8 (Villaseca). This patient constantly rotated the head to the left in order to fix with the left eye which is fixed in a convergent position.

Both eyes were fixed in a convergent position. The child fixed constantly with the left eye with his head rotated toward the left side (fig. 8). An estimate of the degree of strabismus was difficult due to the convergent position of both eyes, and about 50 arc degrees was considered to be an average conjecture (fig. 8). The fundus was normal, O.U.

After seven months of alternate occlusion, the cover test showed that O.S. was able to fix in the primary position with the head straight, and also could abduct about 15 degrees. This eye was, therefore, no longer fixed in the former position. When the left eye was covered, O.D. was still unable to reach the midline and fix in the primary position.

Alternate occlusion was strictly followed until the child was two years of age, when the fixity of the strabismus had disappeared, O.U.

The cover test showed that the child could now fix with each eye in the primary position (fig. 9), although O.D. had short nystagmic movements when fixing. The degree of strabismus was estimated as about 60 when fixing with O.D., and about 50 with O.S. fixing. As can be seen in the photographs a hypertropia of the nonfixing eye was also present (fig. 9).

The objective angle at the synoptophore was approximately +55 degrees, fixing with either eye.

Skiascopy under atropine showed a hypermetropia of 4.0D. and astigmatism with the rule of 2.0D., O.U.

On July 31, 1953, a five-mm. recession of the medial rectus and a 10-mm. resection of the lateral

Fig. 9 (Villaseca). Same patient as in Figure 8 at two years of age. The fixity of the strabismus had disappeared with mere alternate occlusion.

* Demonstrated by electromyography in paretic extraocular muscles by Breinin (Arch. Ophth. 57: 176, 1957).

Fig. 10 (Villaseca). Same patient as in Figures 8 and 9. After a recession-resection operation, O.U., the esotropia disappeared and ocular motility became normal.

rectus were done on the right eye under general anesthesia. Six weeks later the same operation was performed, O.S.

The photographs (fig. 10) show the result 11 days after the second operation. A perfect result with normal lateroversions and good convergence is evident.

Six months later (patient aged two and one-half years), the cover test showed binocular fixation with only a double hyperphoria. All versions were normal. The objective angle at the synoptophore was +12 degrees, with a slight double hyperphoria.

At the age of three and one-half years he showed orthophoria horizontally, with intermittent hypertropia, O.D. Synoptophore: Fixing, O.D., = +13° L/R 12Δ. Fixing, O.S., = +11° R/L 12Δ. Simultaneous perception and fusion at 0°. Intermittent suppression, O.D. Glasses were prescribed (O.U., +2.5D. sph. ⌒ +2.0 D. cyl. ax. 90°) as well as part time occlusion of the left eye.

When last seen the patient was five years of age. The cover-uncover test for distance showed no strabismus (with or without glasses). On the alternate cover test an esophoria of about 3.0 degrees and slight double hyperphoria could be noted. Cover test for near with glasses showed at times orthophoria and at times about five degrees of divergence, O.D. Vision was: O.D., 20/80+ (E test card Bausch and Lomb); O.S. 20/60. All versions were normal (no spasm of the inferior obliques). Near-point of convergence: 10 cm. (O.D. diverges).

Synoptophore: Fixing O.D. = +5° L/R 12Δ. Fixing O.S. = 0° R/L 14Δ (with glasses). Simultaneous perception and fusion at 0° L/R 5Δ. Intermittent suppression. O.D. The power of his glasses was lowered to +1.75 D. Sph. ⌒ +2.0D. cyl. ax. 90°, and part time occlusion, O.S., was ordered.

Discussion

In this case strabismus fixus was probably due to a congenital paralysis of both lateral recti (fig. 8). With alternate occlusion for over a year the fixity of the strabismus disappeared completely, and the patient was then able to fix with each eye in the primary position while the other eye converged about 55 degrees (fig. 9). This case demonstrates that the fixed convergent position of the eyes is reversible at the beginning. Alternate occlusion was able to relax the secondary spasm of the medial recti. If occlusion had not been done and the eyes had remained fixed in their convergent position for a long time, it is highly probable that the functional spasm of the medial recti would have proceeded to an irreversible contracture.

The recession-resection operation in both eyes, at the age of two years, produced orthophoria and normalized the ocular movements (fig. 10).

Case 3

R. I., a five-month-old boy, was first seen in April, 1956. He had presented convergent strabismus since birth. There was no hereditary history of strabismus and both the pregnancy and childbirth had been normal.

The examination revealed both eyes fixed in a convergent and depressed position, similar to the usual reading position of an adult. The child could not look up. Fixation was strictly crossed, using the right eye in the left field and the left eye in the right field. When one eye was covered and the other was obliged to fix a torch held in front, rapid jerks (saccadic movements) tried to carry this eye to the midline.

The fundus was normal.

After four months of alternate occlusion the cover test showed that O.D. could now fix steadily in the primary position, although it could not abduct beyond the midline. O.S. could fix only with rapid jerks, without being able to reach the midline. The child was now able to look upward with both eyes.

Skiascopy under atropine showed a mixed astigmatism with the rule of 2.0D., O.U.

Alternate occlusion of four days, O.D., and two days, O.S., was continued for another four months.

After this O.S. could reach the midline with rapid jerks. O.D. had steady fixation in the primary position but it still could not abduct past the midline. The child usually fixed with his head slightly rotated to the right and with O.D. in a somewhat convergent position. The sum of the deviation of both eyes was estimated in about 45 arc degrees. There

was no change in the amount of horizontal deviation when looking up or down. The objective angle at the synoptophore was approximately +50 degrees. The child was then 13 months of age. Figure 11 shows the child just before surgery when he was 17 months of age.

On April 27, 1957, a recession of five mm. of both medial recti and a resection of eight mm. of the left lateral rectus were done under general anesthesia.

A month later the eyes were orthophoric. Abduction, O.S., was complete. There still existed a partial limitation (of about 10 degrees) of the abduction, O.D.

When last seen 10 months after the operation (two years and three months of age) the cover test was normal both for distance and near. Orthophoria was maintained on looking up or down. Abduction was full in both eyes (fig. 12). No vertical defect was found in the four diagnostic positions of gaze, and convergence was normal.

Synoptophore: Fixing O.D. = 0° L/R 8Δ. Fixing O.S = +5° θ. At the synoptophore, amblyopia of O.S. was evident, as he tried to look at the figure of the left tube with his right eye. Occlusion for three days, O.D., and one day, O.S., was ordered.

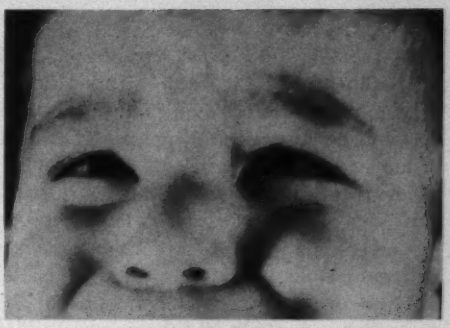

Fig. 11 (Villaseca). Preoperative snapshot taken at the moment of looking to the left, O.D. fixing.

Discussion

In this case there existed since birth a fixed convergent and depressed position of both eyes (strabismus fixus). When the patient was five months of age the cover test showed that each eye could only abandon intermittently its convergent position, with rapid jerks toward the midline. The child could not look upward.

After several months of alternate occlusion, the right eye could fix steadily in the primary position. O.S. could only reach the midline with saccadic movements. Supraversion was normalized in both eyes. In this case alternate occlusion also produced a change in the fixity of the strabismus.

Retrospectively the diagnosis of a congenital paralysis of the left medial rectus with spasm of both medial recti and a probable inhibitional palsy of the right lateral rectus can be made. In fact the resection of the left lateral rectus and recession of both medial recti (at the age of 17 months) corrected the esotropia and normalized the ocular movements of both eyes. The abduction of O.D. also became normal after some time, although no surgery was done on the right lateral rectus, which leads one to think that its palsy was of the inhibitional type.

In the first months of life the congenital paralytic strabismus of this child did not have time to lead to the complete fixation of the eyes in their convergent position. Saccadic movements were still present on the cover test. It is likely that, if his eyes had been allowed to continue using crossed fixation, without doing anything to move them away from their habitual convergent position, the medial recti would have lost their capacity of relaxation, leading, with the passage of time, to a complete fixation of the eyes.

Fig. 12 (Villaseca). The same patient as in Figure 11. Ten months after operation there is orthophoria and full abduction, O.U.

Comments

In the literature it is repeatedly stated (Bielschowsky,[2] Scobee,[4] Duke-Elder,[1] Brown,[5,6]) that strabismus fixus is caused by a congenital structural anomaly (fibrosis) of the medial rectus muscle.

The three cases of fixed strabismus that I have seen in the last 10 years tend to prove the reverse. In Case 1, strabismus was acquired in adult life after a severe cephalic traumatism, with a probable fracture of the base of the skull. It is fair to assume that there was a paralysis of both lateral recti with secondary spasm of the medial recti, and that their final contracture caused the fixity of the strabismus (fig. 2).

In Martinez's case[8] strabismus fixus was also an acquired condition that started when the patient was 30 years of age.

In my Case 2 there existed a congenital bilateral strabismus fixus (fig. 8). To my surprise the fixity of the strabismus disappeared completely after several months of alternate occlusion, and the child was then able to fix with each eye in the primary position, while the other converged about 55 degrees (fig. 9). Therefore, the former fixity of the strabismus was due to a reversible spasm of the medial recti and not to a structural congenital anomaly of those muscles, as it yielded to mere alternate occlusion. A congenital paralysis of both lateral recti was probably the primary trouble.

In Case 3 there also existed a congenital strabismus fixus, with both eyes fixed in a convergent and depressed position. When the patient was five months of age, the fixity was not yet complete, as when one eye was occluded the other had rapid saccadic movements toward the midline. The fixity of the strabismus was greatly improved with alternate occlusion for several months, after which the child succeeded in fixing steadily with O.D. in the primary position, and was able to carry O.S. to the midline with rapid jerks. Supraversion became normal, O.U.

Resection of the left lateral rectus and recession of both medial recti completely normalized the lateroversions (fig. 12), including the abduction of O.D., although no surgery was done in the right lateral rectus. It is logical to assume that this was a case of congenital paralysis of the left lateral rectus with spasm of both medial recti and inhibitional palsy of the right lateral rectus.

Had the child continued to use crossed fixation, without moving his eyes, it is very likely that in the long run the fixity of the strabismus would have been completed, by irreversible contracture and fibrosis of both medial recti and a secondarily established paralysis (by lack of use) of the right lateral rectus.

Case 3 would seem to demonstrate that even a paralysis of one lateral rectus may also lead, in the long run, to a bilateral strabismus fixus, by spasm and later contracture of the contralateral yoke muscle and inhibitional secondary paralysis of its contralateral antagonist.

This situation is in open contrast to those patients, which one sometimes meets, who have a complete paralysis of one lateral rectus with no deviation of the visual axis in primary position, because of the lack of spasm of the medial recti. In the typical cases of Duane's retraction syndrome a very small deviation is also characteristic.

My three cases of strabismus fixus would demonstrate that the finding of a rigid, fibrous, and short medial rectus, pointed out by different authors as the cause of strabismus fixus, is only the consequence (secondary contracture) of the paralysis of both, or less frequently of one lateral rectus. The paralysis of the lateral recti would thus be the primary lesion.

The practical advantage of this conception lies in the possibility of modifying the fixity of the strabismus by an early treatment. The occlusion of one eye prevents its crossed fixation, and forces the other eye to try to move from its position of extreme convergence so as to be able to see toward the tem-

poral field. At the beginning, occlusion is annoying to the child because it compels him to rotate his head strongly toward the side of the nonoccluded eye, so as to be able to look in front of him. After some time the child learns to relax the spasm of the medial rectus, and can thus look onward with his eye not far off the primary position and with a much straighter head (Cases 2 and 3).

Thus, alternate occlusion is indicated in every case of congenital strabismus fixus as early as possible. By doing so it is possible to avoid the secondary contracture and fibrosis of the medial recti and of the adjacent tissues of the inner canthus, including the conjunctiva. With this treatment the strabismus may loose its fixity and become an ordinary case of marked strabismus, capable of correction with the usual recession-resection operation (Cases 2 and 3).

In Case 1, 16 years had elapsed and the contracture of the medial recti had reached extreme degrees (fig. 2). It was obvious that a recession of five or six mm. of the medial rectus would not produce enough rotation to permit the eye to come even near the primary position. Instead of doing a free tenotomy that would cripple the adduction, I decided to try a variant of the guarded tenotomy operation by lengthening the medial rectus with a long bridle of nonabsorbable Supramid.

In fact the purpose of this type of operation was quite different from that of the ordinary guarded tenotomy. In this the bridle is temporary and its only object is to allow spontaneous reinsertion of the muscle to the sclera in a recessed position of not more than five mm. It is used in very young children chiefly to avoid the risk of passing a suture through the superficial layers of the sclera, as in the usual recession operation.

In my patient the objective was to place a long and permanent bridle in the medial rectus, hoping that the muscle would not become reinserted to the sclera farther back but instead would function freely, pulling the eyeball through its bridle fastened at the normal scleral insertion. Furthermore the greater lengthening of the medial rectus would allow a larger resection on the lateral rectus, without causing enophthalmos.

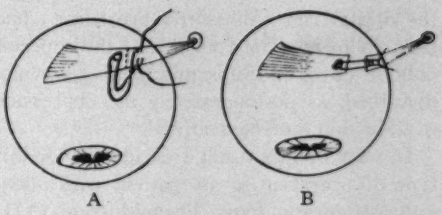

Fig. 13 (Villaseca). Lengthening of the tendon with Supramid bridle sutures in a case of superior oblique tendon sheath syndrome.

A somewhat similar procedure for lengthening a muscle with a bridle had been previously performed by me, in 1956, in a six-year-old girl with a superior oblique tendon sheath syndrome. The superior oblique was explored following Berke's procedure but its tendon was so tense and short that it could not be brought to view with the strabismus hook. The superior rectus had to be disinserted in order to identify the superior oblique under it. As the tendon as a whole was extremely short it occurred to me to lengthen it with a Supramid bridle. A Supramid suture was fastened in the superior oblique tendon at a level with the medial border of the superior rectus and, after making a loop nine-mm. long, it was fastened again to the tendon two mm. more nasally (fig. 13-A). The superior oblique was then cut between the two knots (fig. 13-B). After this, the eye could be elevated freely in adduction with forceps.

Elevation in adduction was partially improved after this operation. In fact the eye that before the operation remained about 15 degrees below the horizontal in that gaze, could afterward be elevated about 10 degrees above the horizontal. A greater elevation in adduction would probably have resulted if Folk's[9] advice of simultaneously advancing the inferior oblique's insertion in

the orbital rim (Wheeler's procedure) had been followed. The function of the superior oblique (with its Supramid bridle) was not disturbed, as postoperatively the depression in adduction remained normal.

In view of this result I decided to try this type of operation in my patient with maximum strabismus fixus. The adduction, O.D., where a Supramid bridle of seven mm. has been placed, is normal (fig. 7-c). Nevertheless, it is possible that the muscle might have become reinserted in the sclera seven mm. behind its normal insertion, and therefore would not act through its bridle. The minimum adduction, O.S. (about 10 degrees), is probably effected through an indirect pull transmitted by the 16-mm Supramid bridle, as a possible reinsertion of the muscle in the sclera so far back should not adduct the eye but retract it into the orbit.

It would be advisable to use Gelfilm to avoid adhesions of either the Supramid bridles or the anterior edge of the muscle to the sclera.

The resection of 11 mm. in the right lateral rectus and 18.5 mm. (in two operations) in the left lateral rectus did not cause enophthalmos, due to the simultaneous lengthening of the homonymous medial rectus provided by the bridle.

This new technique of lengthening a muscle with a permanent bridle would only be indicated in those cases of marked contracture of the muscle body, in which a maximum recession is not considered sufficient. This operation could be tried in any case of abnormal shortage of an extraocular muscle, for example, strabismus fixus, superior oblique tendon sheath syndrome, and possibly in some cases of Duane's retraction syndrome.

In long-standing cases of strabismus fixus it should be kept in mind that there may be a shortage of the bulbar conjuntiva at the inner canthus, as in Case 1. If, after suturing the conjunctiva, the eye tends to remain in a somewhat convergent position and the forced duction test again shows some limitation of abduction, a generous free graft of conjunctiva should be done to free the eye completely.

Conclusions

1. Strabismus fixus can be either a congenital or an acquired condition. A typical case of strabismus fixus acquired after a severe trauma to the head at the age of 20 years, and two congenital cases are presented.

2. In congenital fixed strabismus the fixation of the strabismus is reversible during the first months of life, as it can disappear with mere alternate occlusion. This would indicate that there is initially only a spasm of the medial recti and not a congenital structural anomaly (fibrosis) of these muscles.

3. A paralysis of the lateral recti seems to be the primary trouble, with secondary contracture and (later) fibrosis of the medial recti.

4. A new surgical procedure that allows for an unlimited lengthening of a short muscle is described.

Marcel Duhaut, 2959.

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INHERITANCE OF CONGENITAL ANOPHTHALMIA IN MICE*

II. Effects of cortisone and maternal immunization with brain

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Interpretation of the results of experiments in mammalian teratology conducted on animals having an unknown genetic background may be complicated by the presence of many unsuspected factors. A high degree of susceptibility to deleterious substances results in a confusing picture of the embryonic development that is hard to unravel, while a low degree of susceptibility requires excessively large doses of the teratogenic substance and results in abortion and/or absorption of the embryos. We have built up two large colonies of inbred mice in this laboratory and have studied the susceptibility of these animals to various types of environmental traumas, therefore, we feel that they constitute good material for the study of experimental teratology.

This paper is the second report of a series of experiments designed to test the inheritance of recessive factors for congenital eye defects following sublethal doses of various teratogenic substances to pregnant mice of the same strain. The first report described the effects of trypan blue; the present report is concerned with the effects of maternal treatment with cortisone and with maternal immunization with brain.

Material and Methods

Two inbred colonies of mice that have been maintained and studied in this laboratory for seven years.

1. Mice having recessive factors for bilateral anophthalmia and albinism and in which no other congenital abnormalities have been observed. They were originally obtained from the Roscoe B. Jackson Memorial Laboratory. The defects are present in 100 percent of the inbred stock and are transmitted by both male and female parents. During development the optic vesicles develop normally to the 10th day of gestation, at which time growth of the vesicles is arrested and the vesicles gradually degenerate.[1] When these mice are crossbred to mice having normal pigmented eyes, the hybrid offspring always possess normal pigmented eyes.

2. Mice having dark-gray fur and normal pigmented eyes. These mice were derived from DBA/2 Jax strain and were originally obtained from the Jackson Memorial Laboratory. No congenital defects have been observed in these mice during the past seven years.

Females from each colony are mated in reciprocal crosses and treated with various types of teratogenic agents on specific days in gestation. Some of the females are killed and the embryos examined at definite stages in development, while others are allowed to deliver their young. All matings are for 24 hours, which is considered day one in gestation. The females are three-month-old virgins and weigh not less than 20 gm. Inbred females from the normal colony serve as controls in all experiments.

Treatment and Results

Two types of teratogenic substances were used in the following experiments:

1. *Cortone acetate.*† Three minims of a 1.25-percent solution of cortisone were in-

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† Cortone®, Merck saline suspension.

Fig. 1 (Barber, Afeman and Willis). Horizontal section through the head of an embryo from mother treated with brain. The eyes are present and contain pigment but are retarded in development.

jected subcutaneously on the seventh, eighth, and ninth day of gestation or just prior to the time, 10th day, at which the optic vesicles cease growing in the anophthalmic strain. Stronger doses of cortisone resulted in abortion and/or absorption of the embryos.

Cortisone, as the teratogenic agent, did not disturb the normal development of eyes in either the controls or the hybrid embryos. However, there was a significant number of hybrids with absence of pigment in the eyes and fur. Of 520 hybrid offspring, there were 62, or 11.9 percent, albinos. Albinism is a recessive trait in the genotype of one parent. There was no instance of albinism among the controls, that is, inbred mice having pigmented fur and eyes.

2. *Maternal immunization.* A homogenate was prepared according to the technique described by Freund.[2] It contained 15-percent brain tissue, 55-percent normal saline and 30-percent Freund's complete adjuvant. The brain tissue was taken from animals of each colony and pooled. Injections (0.1 cc.) were given intramuscularly in each hind leg of female mice taken from each colony three times at weekly intervals (total 0.6 cc). The females were inbred and crossbred one week after the last injection and the embryos were removed the 13th day of gestation. Control females, inbred and crossbred, received a solution containing 70 percent normal saline and 30 percent Freund's complete adjuvant.

Eighty-five embryos were obtained from eight pregnant mice treated with brain and all showed approximately the same degree of retardation (fig. 2). This was true of both the inbred normal and crossbred females. The eyes contained pigment but were retarded in development, (fig. 1). The central nervous system appeared to be fairly normal except for the absence or retardation of the hypophysis and infundibulum. In some embryos serial sections revealed no evidence of the initiation of development of either Rathke's pocket or of the infundibular process (fig. 3A); in others, it was present but poorly developed (fig. 4). The axial structures were also poorly developed, the tongue and lower jaw were almost completely suppressed and the heart and liver were poorly differentiated. Treatment of control females with Freund's complete adjuvant and normal saline had no harmful effect on the development of either the inbred or hybrid embryos (fig. 3B). The photographs shown in Figures 3A and 3B were taken at the same magnification and illustrate the marked difference in size between the embryos from mothers treated with brain and the controls.

Discussion

As stated before, our aim is to use sublethal doses of various teratogenic substances

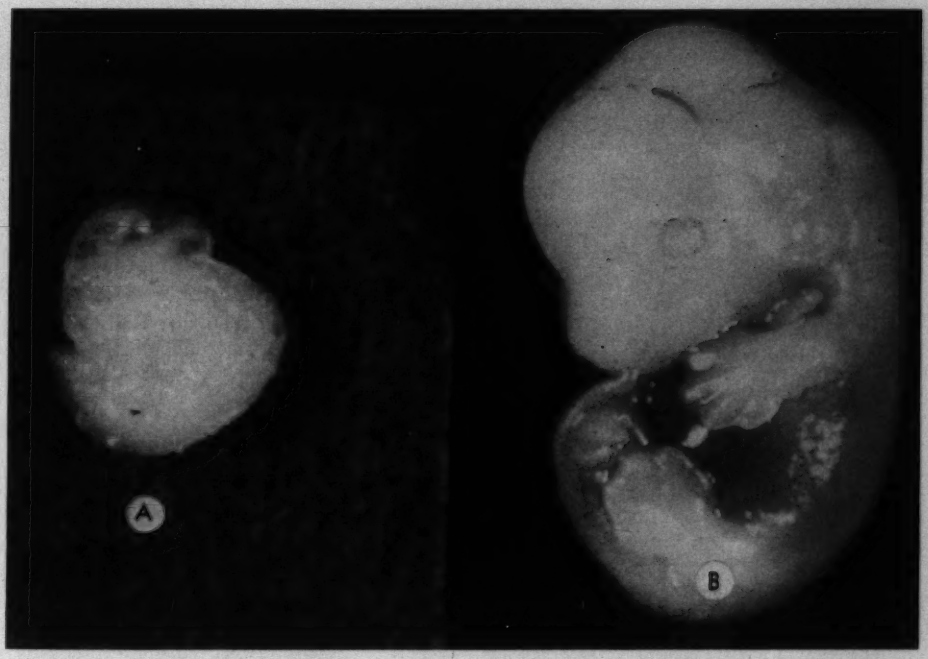

Fig. 2 (Barber, Afeman and Willis). Mouse embryos removed on the same day (13th) in gestation and photographed at the same magnification. The embryo on the left (A) is from mother injected with 15 percent brain, 30 percent Freund's complete adjuvant and 55 percent normal saline; the embryo on the right (B) is from mother injected with 30 percent Freund's complete adjuvant and 70 percent normal saline.

on as nearly a stable genetic background as possible. Such a genetic complex is difficult to find among mammals. There is almost always some fetal loss even among untreated animals. However, we have tried to minimize this loss by removing the embryos in early stages of gestation in many of our experiments.

We have also tried to standardize a sublethal dosage for each teratogenic substance. There is a difference in the degree of susceptibility to injurious agents even in an inbred colony of animals and a more marked difference between strains.[3,4] All the different teratogenic agents that we have used thus far, if given in excess, have caused widespread trauma to the embryos and have obscured any specific effect on a single organ or on the inheritance of a recessive trait. Thus craniorachischisis can be caused equally well by severe dosage with trypan blue, cortisone, and X rays.[5-7] We have not tried to analyze the mode of action of the teratogenic agent but rather to study its effects on the inheritance of a fairly well defined genetic complex.

Inheritance is defined as a mode of response of the genotype to the environment[8] and every genotype reacts with its environment in a characteristic manner. There is undoubtedly a certain range of flexibility in the genic response which results in the development of an organism within the range of normal for its phenotype. Sometimes, however, the environment may produce a permanent change (mutation) in the genotype which then opens up a new range of response. Goldschmidt proposed the term phenocopy to describe an environmental or experimental change in a phenotype that is a

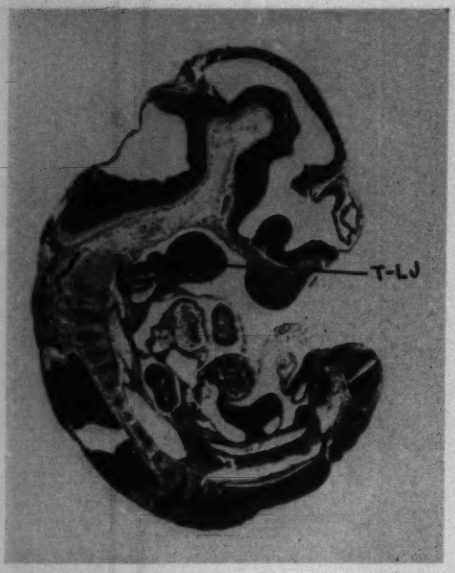

Fig. 3A (Barber, Afeman and Willis). Sagittal section through an embryo from mother treated with 15 percent brain. (Same embryo shown at left in Figure 2.) Development is generally retarded and the hypophysis is absent. (H, hypophysis; T-J, tongue and lower jaw).

replica of a variant already known to be due to a change in the genotype.[9] He also felt that the processes underlying the formation of phenocopies are the same as those set in motion by the mutant gene. On the other hand, Landauer expresses the belief that modifications of development with morphologically similar end-effects can be produced by chemically specific interference at different points along one and the same pathway of metabolic functions; and that these developmental defects may be of genetic as well as experimental origin.[10] In our experiments we have created replicas of variants known to be present in the genotype, therefore, we assume these defects to be phenocopies. It is the pathway of response that is interesting.

Our previous experiments using sublethal doses of trypan blue dye indicated that a teratogenic agent may create an environmental stimulus or metabolic disturbance in the uterus comparable to that controlled by a genetic complex and result in the expression of a recessive congenital trait that would otherwise be suppressed.[6] The time intervals and stage of development in those experiments are comparable to the present series; that is, 0.25 cc. injections of a 0.3 percent solution of the dye was given on the seventh, eighth, and ninth days of gestation.

Gilbert and Gillman[11] in their work on trypan blue felt that, "the erythrophagocytosis occurring soon after injection may lead to an acute anaemia accompanied by a decreased oxygen supply to the maternal tissues." If this is the case, the effect of maternal hypoxia resulting from injections of trypan blue on the embryos appears to be similar to the effect of the recessive factors for anophthalmia. Also this effect seems to be specific for anophthalmia since no change

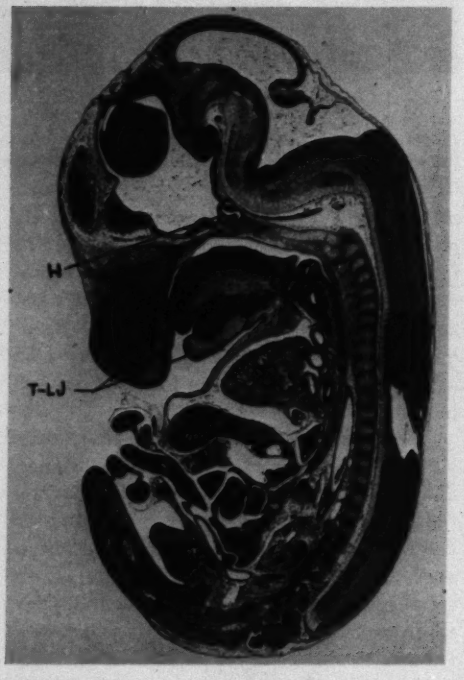

Fig. 3B (Barber, Afeman and Willis). Sagittal section through an embryo from mother used as a control. (Same embryo shown at right in Figure 2.) Development is normal.

was manifested on the recessive factors for albinism.

Eye defects as well as a broad array of other abnormalities have been reported following maternal treatment with trypan blue[11] and cortisone[12] in mice and in other species of animals, but there is very little information regarding the genetic complex of these animals. Also, except for Landauer's work on the chick, there has been very little investigation of the effects of several teratogenic agents on a single strain of animals.

In the present experiments, cortisone seems to have the same potential as trypan blue but its influence is directed toward the recessive factor for albinism instead of the factors for anophthalmia. Cortisone appears to disturb the mechanism responsible for the metabolism of pigment in the hybrids and thus results in the production of a congenital defect that is suppressed in hybrids from untreated mothers.

One of the major metabolic effects of cortisone is to prevent the synthesis of protein (anti-anabolism); also, hydrocortisone and probably other constituents of the cortical secretions are involved in the control of pigmentation.[13] In these experiments, cortisone appeared to be specific in its action, since it produced an effect only on pigmentation. On the other hand, trypan blue also appears to create a specific effect on the development of the eyes and nothing else.

Maternal immunization

Gluecksohn-Waelsch[3] reported a series of experiments in which she demonstrated that immune substances were capable of interfering with differentiation in a normal mammalian embryo. In her first experiments she used a highly inbred strain of mice (BALB/G1w) which had to be abandoned because of the sporadic incidence of brain abnormalities in the strain. She chose another strain of mice, DBA 1/Jax, free of sporadic abnormalities and emphasized the importance of collecting a sizable control group from any strain used for experiments in which abnormalities are to be produced artificially.

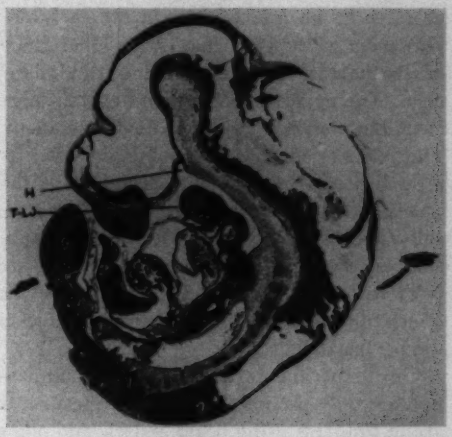

Fig. 4 (Barber, Afeman and Willis). Section through the head of litter mate of embryo in Figure 3A, showing retardation in development of the hypophysis (H). Compare with Figure 3B.

Our interest in maternal immunization arose from a desire to test the effects of a specific brain antigen on the development of the eyes in our mice. In our first experiments we followed Gluecksohn-Waelsch's method and gave injections containing 10 percent brain, 60 percent normal saline and 30 percent Freund's complete adjuvant but found that this method had no teratogenic effect on either inbred normal or hybrid embryos of our strains. We increased the percentage of brain to 15 percent and found that at this strength we had created a teratogenic reaction. The results were practically the same in all embryos removed on the 13th day of gestation and the same for both inbred normal and crossbred hybrids (figs. 1 and 2).

The results of our preliminary experiments with brain injections are consistent with those reported by Gluecksohn-Waelsch. She states that abnormalities of the central nervous system only appeared in embryos from mothers injected with brain. In our animals the effect seems to be centered on the initiation and development of the hypophysis and infundibular process. There ap-

pears to be no interference in the early development of the eyes, that is, the inheritance of the factors for anophthalmia and albinism. The eyes are present and contain pigment but they are retarded in development. The effect on the hypophysis with its growth-promoting influence seems to be the crucial point in the teratogenic chain of results (figs. 3A, 3B, and 4). Chemical substances produced in one part of the body circulate through it and produce specific effects on other parts which are sensitive to the particular hormone.

Our experiments in maternal immunization are only preliminary; other experiments are in progress using heart, muscle and other tissue emulsions. However, the results are useful here in demonstrating the difference in results following various types of teratogenic agents in the same strain of animals. Wilson concludes, "That different agents produce different patterns of abnormality implies that they either act at different times in development or on different phases of the developmental process at any given time." He also states that time-specificity and agent-specificity are definite aspects in the analysis of the mode of action of teratogenic agents. We would like to add that a thorough knowledge of the genetic response of the genotype and its susceptibility to environmental changes is also very important.

Summary

Mice having recessive factors for anophthalmia and albinism were mated with mice having dominant factors for eyes and pigmentation. The pregnant females were treated with two different types of teratogenic agents, that is, cortisone and maternal immunization with brain. Control mice, in which each parent carried dominant factors for both defects, received the same treatment.

Cortisone

Three minim subcutaneous injections of a 1.25 percent solution of cortisone were given on the seventh, eighth, and ninth days of gestation; stronger doses resulted in abortion. Some of the embryos were studied in early stages of development while others were examined at birth. Cortisone did not interfere with the development of the eyes in either the controls or the hybrids, however, about 12 percent of the hybrid offspring showed albinism whereas the controls were normally pigmented. Thus maternal treatment with cortisone resulted in the expression of a recessive trait, albinism, in hybrids but did not affect normal pigmentation in the inbred controls. In these experiments, cortisone, used as a teratogenic agent, seems to produce a specific environmental stimulus strong enough to overcome the action of the dominant factors. The results produced by cortisone are discussed in relation to the teratogenic effects of trypan blue on recessive anophthalmia described in a previous paper.

Maternal immunization

Intramuscular injections (0.1 cc.) containing 15 percent brain, 55 percent normal saline and 30 percent Freund's complete adjuvant were given in each hind leg of female mice three times at weekly intervals (0.6 cc.), and the females were mated one week after the last injection. Matings were made between mice with normal eyes and with anophthalmic mice. Control mice were given injections containing 70 percent normal saline and 30 percent Freund's complete adjuvant. Maternal immunization with brain did not alter the inheritance of recessive factors for anophthalmia or albinism, however, it did result in either absence or faulty development of the hypophysis and retardation in the development of the embryo as a whole.

Conclusion

Thus maternal treatment with cortisone and trypan blue dye appears to have a specific effect on the inheritance of recessive genetic factors, whereas maternal immunization with brain does not affect the develop-

ment of the eyes but appears to have a specific effect on the development of the central nervous system of the embryo, specifically the development of the hypophysis and the infundibulum, and consequently stunts the growth of the embryo generally.

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DACRYOCYSTORHINOSTOMY WITH WIRE FISTULIZATION

An additional report

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Since the first case of dacryocystorhinostomy with wire fistulization was reported,[1] the procedure has been modified and performed on over 30 patients. Because of the high rate of success with this fistulizing procedure, it was felt a description of the newer modifications should be reported.

Surgical technique

A. Anesthesia.

Depending on the age, physical condition, and type of patient, either general or local anesthesia may be used. With either type, the nostril on the operative side is first packed with a four-percent cocaine-adrenalin nasal pack. When performed under local anesthesia, the following steps are followed:

Systemic sedation with Nembutal, 3.0 gr. (depending on the age and weight of the patient) two hours before surgery; Trilafon (10 mg.) one hour preoperatively; Demerol 100 mg. (depending on the age and weight of patient) 45 minutes before surgery. Local instillation of Pontocaine (0.5 percent) into the conjunctival sac. Injection of a solution containing two-percent procaine, adrenalin (1:1000) and Alidase (150 units to the ounce) to the operative area so as to block the supratrochlear, infratrochlear and infraorbital nerves. If general anesthesia is

Fig. 1 (Abrahamson and Abrahamson). Incision of the skin.

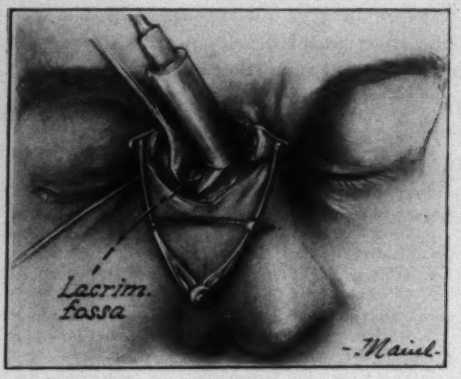

Fig. 3 (Abrahamson and Abrahamson). Stryker saw trephine straddling lacrimal crest.

used, sodium pentothal is preferred, with the patient intubated.

B. Incision

Following sterile preparation with Phisohex and drape, a slightly curved vertical[2] incision about 1.5 cm. long is then made through the skin (fig. 1) with a No. 15 Bard-Parker knife, three to four mm. nasal to the inner canthus, holding the skin tense with the thumb and index finger of the left hand. Starting at the fold of the upper lid, the incision is carried three mm. below the orbital rim down to the nasal bone. To orient oneself as to the exact location of the sac, a No. 2 Bowman's probe is inserted through the lower puncta, canaliculus, and into the sac. The incision is deepened with blunt scissors, care being taken to avoid injuring the angular vein. Fine separation with a periosteal elevator is then performed to separate the lacrimal sac from the fossa by elevating it laterally from above downward. Constant suction and hemostasis are applied as needed to keep the field dry (fig. 2).

Starting at the anterior lacrimal crest avoiding the medial palpebral ligament (since cutting this will not help sac exposure but will later produce cosmetic deformity) dissection is carried to the posterior crest using a periosteal elevator, freeing the sac and

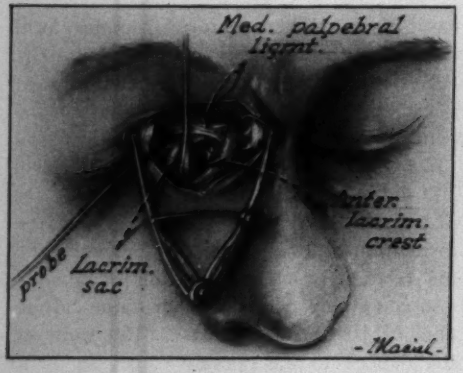

Fig. 2 (Abrahamson and Abrahamson). Dissection of sac from lacrimal fossa. Wound separation by Fink speculum.

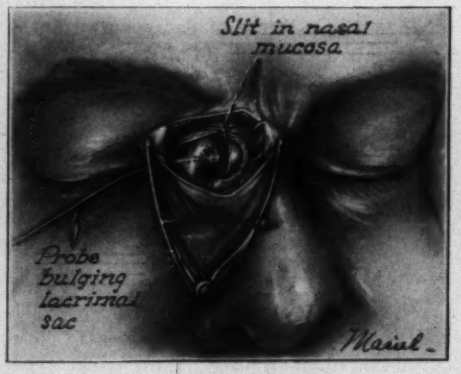

Fig. 4 (Abrahamson and Abrahamson). Incision of nasal mucosa at osteotomy. Lacrimal probe in sac.

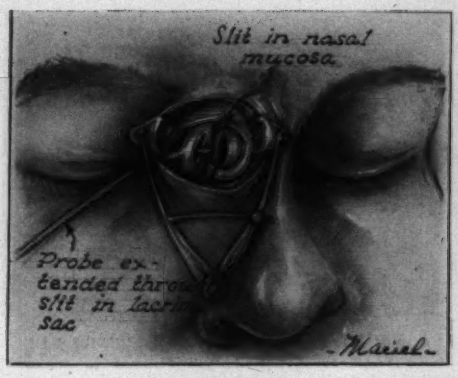

Fig. 5 (Abrahamson and Abrahamson). Incision of lacrimal sac.

Fig. 7 (Abrahamson and Abrahamson). Steel wire inserted through Veirs needle into nose.

periosteum from the lacrimal fossa. To aid the dissection, as well as provide superficial hemostasis, the skin edges and subcutaneous tissue are then separated with a special Fink dacryolacrimal speculum[3] with 3.0 by 3.0, sharp-pointed tooth, deep swivel blades. The sac is then pulled temporally with an Allis clamp as dissection continues with the periosteal elevator to create a 1.5-cm. space over the nasolacrimal bone.

Instead of using a hammer, chisel and rongeurs to make a window opening in the nasolacrimal bone, the hand Stryker bone saw[4,5] with a special Iliff trephine blade 10 mm. in diameter is used. The blade is placed so as to straddle the anterior lacrimal crest while being directed nasalward and slightly backward (fig. 3). A metal guard similar to that described by Bonaccolto[5] is used to prevent the trephine from slipping and injuring the sac or eye.

With slight rotation of the saw to aid the oscillating cutting action and saline irrigation to prevent burning the bone, a very rapid, clean, smooth opening is made, with the nasal mucosa usually being left intact. The bone plug of the anterior crest (maxillary bone) and lacrimal bone is removed from the drill blade and all dust particles are aspirated by suction. No bone spicules are encountered by this method and an adequate nasal bone window is obtained.

The nasal pack is then removed and a longitudinal incision is made in the nasal

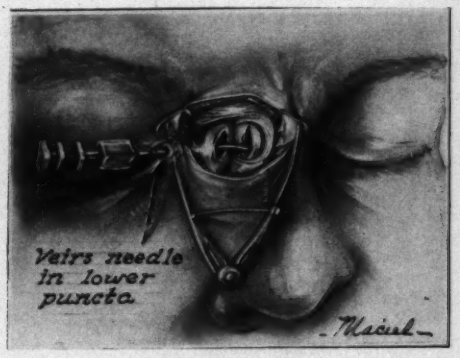

Fig. 6 (Abrahamson and Abrahamson). Veirs needle introduced through sac and osteotomy.

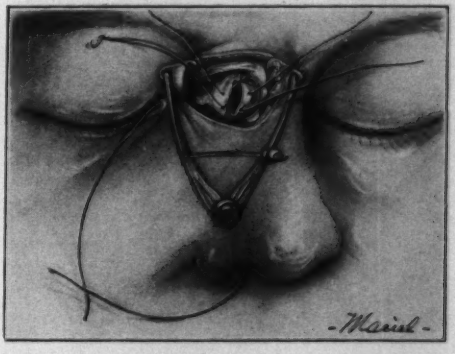

Fig. 8 (Abrahamson and Abrahamson). Suturing of the posterior lips of the nasal mucosa and lacrimal sac.

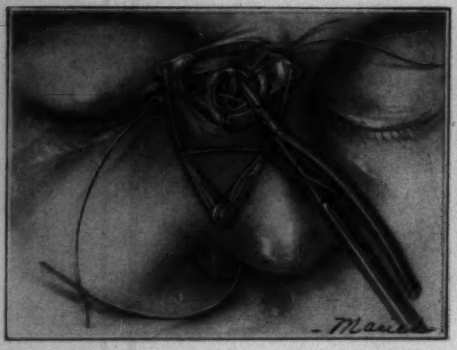

Fig. 9 (Abrahamson and Abrahamson). Suturing of the anterior lips of the nasal mucosa and lacrimal sac.

mucosa (fig. 4). With the lacrimal probe in the sac for better identification, a similar incision is then made in the posterior or inner wall of the lacrimal sac exposing the probe (fig. 5). Next, the probe is removed and a Veirs needle is inserted through the lower puncta, canaliculus, sac opening, osteotomy and into the nose (fig. 6). The stylet is then removed and a No. 20 stainless steel wire is inserted through the Veirs needle into the nose (fig. 7). The Veirs needle is then withdrawn and the wire united in a circular manner with the other free end extending from the lower puncta.

Using special Ethicon suture (B-798) on

Fig. 10 (Abrahamson and Abrahamson). Suture of skin wound. Steel wire in position

Fig. 11 (Abrahamson and Abrahamson). Acute dacryocystitis.

dacryo (G-2) needles, three 4-0 double-arm chromic catgut sutures are inserted through the posterior lips of the nasal mucosa and lacrimal sac (fig. 8). Then three similar sutures are used to approximate the anterior lips of the nasal mucosa and lacrimal sac as suggested by Lathrop[6] and devised by Dupuy-Dutemps[7] (fig. 9). Occasionally this step is difficult due to the friability of the nasal mucosa, so the posterior lip of the lacrimal sac is excised and the anterior lip of the lacrimal sac is sutured to the anterior lip of the osteotomy or to subcutaneous tissue after the friable nasal mucosa is completely removed from the osteotomy. This keeps the opening of the lacrimal sac permanently in contact with the osteotomy for tear drainage into the middle meatus of the nose and prevents further adhesions.

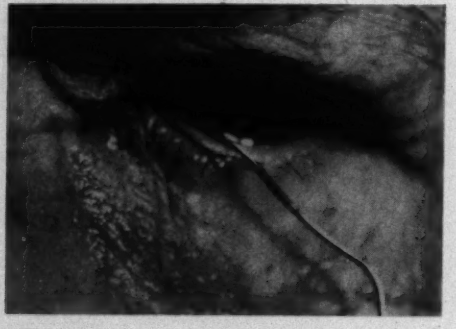

Fig. 12 (Abrahamson and Abrahamson). Postoperative dacryocystorhinostomy with wire in position.

Two deep 3-0 plain catgut sutures are used to approximate the subcutaneous tissue and the skin is closed with interrupted 6-0 black silk sutures (fig. 10). The wire is then so adjusted as to leave a one-cm. portion parallel to the lid margin (this prevents tearing of the canaliculus). The two free ends of the wire are joined and taped flatly to the cheek (figs. 11 to 13).

A one-cc. solution of penicillin (2500 u./cc.) is injected through the nasolacrimal apparatus. The nostril on the side of surgery is packed with a vaseline gauze pack which remains in place for 24 hours. Sodium sulamyd (10-percent) ophthalmic ointment is instilled in the conjunctival sac and over the wound margin and a pressure dressing is applied for 48 hours.

No undue reaction or pain should be experienced by the patient. After 48 hours, when the dressing is removed, sodium sulamyd (30 percent) ophthalmic solution is instilled three times a day and Neosynephrine nose drops (0.25 percent) are instilled into the nostril on the side of surgery, also three times a day. The skin sutures are removed in five days. The steel wire is jiggled in a circular motion for one minute five times a day for 21 days to create a fistulous tract.

The nasal lacrimal apparatus is irrigated with penicillin solution after the wire is removed and again two weeks later.

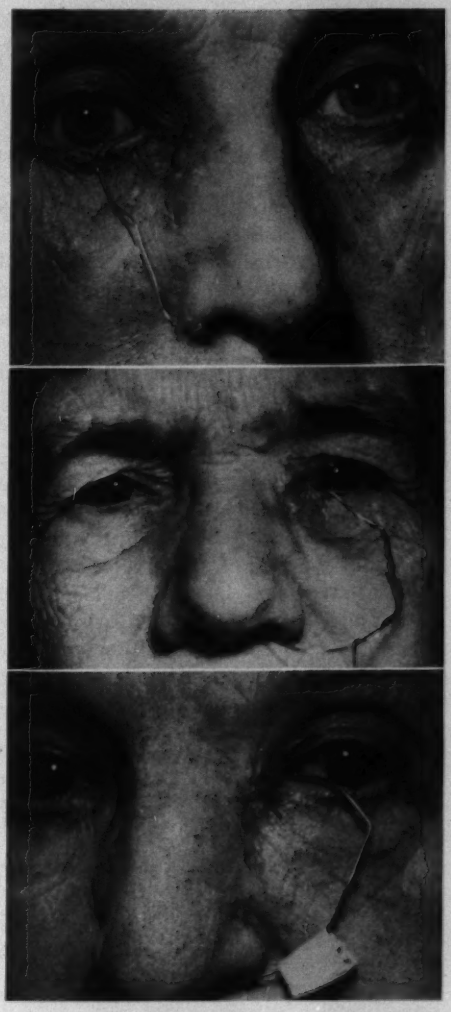

Fig. 13 (Abrahamson and Abrahamson). Representative cases with steel wire in position through puncta, canaliculus, lacrimal sac, osteotomy, and into nose.

Case analysis

Since a description of each of the 30 cases separately would not be too instructive, general analyses of this group, covering the pertinent points therefore follows:

1. Indications

a. Acute or chronic dacryocystitis—this procedure was performed successfully on 30 successive patients of whom over half had either acute or chronic dacryocystitis that would not respond to medical therapy.

b. Chronic epiphora—the remaining half had as chief complaint chronic epiphora but the nasal lacrimal apparatus failed to irrigate or respond to Bowman probing.

2. Age, sex and color

Ages ranged from 10 to 77 years of age. Sex was evenly divided. Five of the 30 patients were Negroes.

The operative procedure performed was

quite similar in almost all cases. Following surgery no case produced further symptomatology or required reoperation.

Discussion

Obstruction of the nasolacrimal apparatus usually takes place at the mouth of the lacrimal duct where it narrows and leaves the lower portion of the sac. The canaliculus is patent, a prerequisite for this operation, and tears or pus can usually be expressed into the eye when pressure is applied over the lacrimal sac.

Preliminary nasal examination to rule out deviated septum, nasal polyps, or chronic sinusitis is important before performing surgery. Failures have been reported[8, 9] as a result of pathologic nasal conditions, with the formation of adhesions or granulation tissue postoperatively instead of reformation or closure of the wall of the lacrimal sac. The use of the wire to form a fistulizing tract helps prevent this complication. Also, if the osteotomy should close at a later date, the Veirs needle could easily be reinserted through the puncta, canaliculus, sac, osteotomy, and into the nose and another wire inserted to produce another fistulous tract (as an office procedure); however, in our 30 cases, this was never required.

Summary

Thirty successive cases of nasolacrimal duct obstruction received a dacryocystorhinostomy as described in this article.

The important modifications stressed are:

1. The use of a Stryker hand saw to create a large osteotomy quickly, smoothly, and cleanly.

2. The use of a Veirs needle to insert the steel wire easily.

3. Fine dacryo needles are now used to facilitate suturing of lacrimal and nasal mucosa in a confined space.

Emphasis is again placed on the use of a stainless steel wire through the lower puncta, canaliculus, lacrimal sac, osteotomy and nose for 21 days. By jiggling this wire five times daily, a permanent fistulous tract is established which rarely ever becomes plugged by scar tissue.

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BACTERIAL CORNEAL ULCERS*

With special reference to those caused by Proteus vulgaris

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Central bacterial corneal ulcers are most often caused by the following organisms: Pseudomonas aeruginosa, Diplococcus pneumoniae, Klebsiella pneumoniae, streptococci, and more rarely, Staphylococcus pyogenes var. aureus, and Escherichia coli.[7] An organism seldom mentioned in reports as a cause of corneal infections is Proteus vulgaris. Duke-Elder[4] states that P. vulgaris is a rare pathogen in the conjunctiva which may produce a chronic catarrhal inflammation, but makes no mention of corneal ulceration. Braley[2] reports this bacterium as an etiologic agent of corneal ulcers which tend to occur in older people, commonly after injury.

Proper management of the severe corneal ulcers caused by bacterial infection is most important because these lesions progress rapidly and may be extremely destructive. Clinically, these ulcers cannot be distinguished on an etiologic basis, and, therefore bacteriologic cultures and sensitivity studies should be done. The expense of such laboratory work is clearly warranted by a lesion which may cause blindness. The following cases of corneal ulcers caused by Proteus vulgaris illustrate the importance of bacteriologic study to the clinician.

Case reports

Case 1

This 60-year-old Negro suffered a superficial corneal trauma, O.S., from a foreign particle originating in a steel plant. Two days after this injury he was seen by his local ophthalmologist and treated with Sulamyd and Propion drops, atropine, and oral Erythromycin and Gantrisin. The ulcer was cauterized at once with trichloroacetic acid. After two weeks of this therapy there was still a three-mm. dense gray ulceration of the superficial cornea. The lesion was surrounded by marked corneal edema, numerous striae of Descemet's membrane were present, flare and cells were moderately pronounced. Vision was reduced to counting fingers.

Upon referral the patient was placed on Albamycin 250 (mg. q.id.) and Chloromycetin (250 mg. q.i.d.). Neosporin ointment was instilled every two hours and atropine daily. Despite this, very little improvement occurred during five days in the hospital. Iodine cautery and curetting of the necrotic surface material produced only minimal improvement. Bacteriologic identification of Proteus vulgaris and sensitivity studies led to the injection of Streptomycin (1.0 gm. q.d.). The first day following Streptomycin there was pronounced decrease in corneal edema, the ulcer was smaller and the eye felt much more comfortable. The subsequent course was uneventful. A local scar remained.

Case 2

A 17-year-old Negro boy suffered a full-thickness laceration of the upper lid when he was nine years of age. He was left with a marginal notch and a large vertical scar. Surgical repair of the notch and scar was done, and the upper and lower lid margins were approximated with the use of Frost sutures. At the time of suture removal five days postoperatively, a three-mm. paracentral corneal ulcer was found. A mild flare was associated with this. The patient was started on Neosporin ointment every hour.

Culture and scraping were submitted for bacteriologic studies. Bacteriologic studies demonstrated Proteus vulgaris which was sensitive only to Chloromycetin, streptomycin, neomycin, and furacin. The patient was, therefore, continued on Neosporin and the ulcer healed with minimal scarring within a week.

Discussion

As already mentioned, infections of the cornea due to Proteus vulgaris are indeed rare. Even isolation of the organism from normal or infected conjuctivas is relatively uncommon. Thus, Smith[5] found P. vulgaris in only 14 out of 4,126 cultures taken from healthy conjunctivas. Allen and Wood[1] found this organism only once in 285 cases of catarrhal conjunctivitis, and Suie[6] also reported the organism only once in a series of 381 cases of conjunctivitis. Although P. vulgaris is only rarely encountered in the eye,

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TABLE 1

INCIDENCE OF BACTERIAL ISOLATES IN 50 CONSECUTIVE CASES OF CORNEAL ULCERS

Organism	Incidence (No. of Cases)
Staphylococcus pyogenes—coagulase positive	4
Hemophilus influenzae	1
Pseudomonas aeruginosa	9
Beta streptococci	1
Gamma streptococci	1
Diplococcus pneumoniae	1
Klebsiella pneumoniae	1
Staphylococcus pyogenes—coagulase negative	13
Diphtheroids	2
Negative	17

it must be stressed that recent surveys of bacterial ocular infections have indicated that gram-negative rods are being isolated with greater frequency.[3, 5, 6] Smith[5] has suggested two reasons for this; first, organisms which are destroyed by antibiotic treatment are being replaced by the gram-negative rods, and, secondly, these bacteria may be introduced to the eye by unsterile ophthalmic drugs. This second method is, indeed, a well-known way to infect the cornea with Pseudomonas aeruginosa.

Table 1 shows our bacteriologic findings in a series of 50 consecutive infectious central corneal ulcers, exclusive of the two cases reported in this paper. If one considers Staphylococcus pyogenes (coagulase negative), and diphtheroids as having no potential pathogenicity, it will be noted that definite etiologic diagnosis could be made in 36 percent of the cases. It is apparent, however, of these, more than 50 percent were due to gram-negative rods.

Comparison of the antibiotic sensitivity of P. vulgaris and P. aeruginosa is given in Table 2. It is important to note that the two strains of Proteus were not sensitive to Polymyxin B while the eight strains of Pseudomonas demonstrated a very high degree of sensitivity to it. The seriousness of corneal ulcers coupled with the variable susceptibility of gram-negative rods (especially Proteus) emphasizes the real necessity for isolating the causative agent and determining its antibiotic sensitivity.

SUMMARY

1. Two recent cases of Proteus vulgaris corneal ulcers are reported because of: (1)

TABLE 2

COMPARISON OF IN VITRO ANTIBIOTIC SENSITIVITY OF P. VULGARIS AND P. AERUGINOSA ISOLATED FROM CORNEAL ULCERS

	Number of Strains Susceptible	
	P. vulgaris (2 strains)	*P. aeruginosa* (8 strains)
Aureomycin		
60 mg.	1	6
30	0	5
10	0	5
Bacitracin		
20 mg.	0	0
20	0	0
2	0	0
Chloromycetin		
60 mg.	2	6
30	2	5
10	1	5
Dihydrostreptomycin		
100 mg.	2	3
10	1	2
1	0	1
Penicillin		
10 units	0	0
1	0	0
0.5	0	0
Polymyxin B		
30 mg.	0	8
10	0	6
5	0	6
Terramycin		
60 mg.	1	6
30	1	6
10	0	6
Neomycin		
60 mg.	2	8
30	1	3
10	0	2
Tetracycline		
60 mg.	1	7
30	1	7
10	0	5
Erythromycin		
10 mg.	0	0
1	0	0
Furacin		
100 mg.	2	2

the rarity of this organism in ocular infection, (2) the ability of this organism to produce severe ocular infections, and (3) the resistance of this organism to many of the commonly used antibiotics.

2. These cases emphasize the importance of bacteriologic studies, including antibiotic sensitivity tests, of lesions which may cause blindness.

Addendum

Since the publication of the above two cases, another patient with a posttraumatic proteus corneal ulcer has been seen. This strain of proteus was sensitive in vitro to neomycin, albamycin, Chloromycetin, streptomycin, and Furacin. Because none of these were effective clinically the ulcer was cauterized with trichloroacetic acid. This dramatically halted the progression of the ulcer with subsequent rapid improvement and complete healing. (This patient was seen through the courtesy of Dr. C. H. Howarth.)

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EVALUATION OF KENACORT® (TRIAMCINOLONE) IN THE TREATMENT OF UVEITIS*

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In recent years, because of the widespread use of corticosteriods, emphasis has been placed on the development of chemical analogues of hydrocortisone and cortisone, which retain therapeutic effectiveness while producing minimal side-effects.[5,8,9,15] Numerous synthetic derivatives of cortisone and hydrocortisone have been prepared. Studies of some of these analogues have confirmed the fact that alterations in the corticoid structure may produce specific and selective modifications of metabolic activity.

Recently a new corticosteroid, Triamcinolone, a 9-alpha-fluoro, 16-alpha-hydroxy derivative of prednisolone (Kenacort, Squibb) has been introduced. When a 16-alpha-hydroxy group is added to a 9-alpha-fluoro steroid the sodium-retaining potency is lost without loss of glucocorticoid activity.[2]

In general, there is a poor correlation betwen the "mineral" effects of triamcinolone and its "organic metabolic-regulating" effects.[19] In the estimation of eosinopenic and hyperglycemic potencies, results seem to indicate that the potency of triamcinolone is approximately 1.25 times that of prednisolone, 1.3 times as powerful as prednisone and approximately 4.4 times that of hydrocortisone.[16]

Triamcinolone is not metabolized into 17-hydroxysteroids; therefore, the excretion of 17-hydroxysteroids is decreased. It is also an effective ACTH inhibitor. The potency of this hormone as an anti-inflammatory agent has been reported as stronger than that of previous preparations.

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The purpose of this study was to determine the comparative response of various types of uveitis to oral administration of triamcinolone. The oral route of administration was employed to minimize complications that may be encountered using subcutaneous administration.

Procedure

All patients with uveitis were admitted to hospital for complete diagnostic investigation and treatment. Each case underwent the following work-up: (1) history and complete physical examination; (2) evaluation of ocular status, including (a) visual acuity, (b) external ocular examination, (c) biomicroscopy of the anterior segment, angle, lens and vitreous, (d) funduscopy (direct and indirect), (e) visual fields, (f) fundus photography at specific intervals, and (g) tonometry; (3) medical, ear, nose and throat, and dental consultations; (4) roentgen studies of the skull, sinuses, teeth, chest and extremities, when indicated; (5) laboratory studies which included, (a) complete blood count, (b) blood sugar, (c) bleeding time, (d) blood electrolytes, (e) coagulation time, (f) sedimentation rate, (g) VDRL flocculation tests for syphilis, (h) serum agglutination tests for typhoid and paratyphoid groups, proteus vulgaris OX-19, and brucella abortus, (i) urinalysis, (j) skin tests—mantoux brucellosis, frei and (when indicated) toxoplasmosis, and (k) stool and urine specimens for parasites.

In suspected cases, or when indicated, further examinations were carried out, such as: (1) In suspected tuberculosis cases, examination of sputum and inoculation of guinea-pigs; (2) blood cultures; (3) lumbar puncture; (4) cultures of sinus washings; (5) sickle-cell electrophoresis; (6) bone-marrow studies; and (7) virus studies.[20]

Therapy

It has been said that there is no such thing as a course of steroid therapy.[6] The daily dose and duration of therapy were individualized in each case, depending upon the response of the patient. Sufficient amounts were employed initially to suppress the activity of the disease completely. Discontinuation of therapy involved gradually decreasing dosage until such time as cessation of medication was not followed by a recurrence of activity. The initial dose was 8.0 mg., three times daily. The maintenance dosage depended upon the patient's response. In reducing the dose, about 4.0 mg. were deducted from the daily dose each fourth day. Upon discharge the maintenance dose averaged 4.0 mg. twice daily, eventually 4.0 mg. daily. The average hospitalization period was two weeks and after discharge the patient was seen twice weekly.

Results

This series consisted of 20 cases of uveitis, which were classified as:

a. Granulomatous, of which there were nine cases (table 1).

b. Nongranulomatous, of which there were 11 cases (table 2).

The 11 cases of nongranulomatous uveitis consisted of: (a) herpes zoster with uveitis, two cases; (b) idiopathic, six cases; (c) traumatic, three cases.

The granulomatous group (table 1)

In spite of thorough diagnostic investigation, the results were inconclusive, with the exception of E.O. (No. 11, table 1) whose case was diagnosed as one of luetic uveitis. The course of the disease in this group characteristically showed frequent flare-ups that were limited to the anterior segment.

In addition to the triamcinolone therapy, certain cases received additional medication:

1. Three cases suspected of tuberculosis received: dihydrostreptomycin, streptomycin, isoniazid, and P.A.S. Leopold, Kratka, and Lepri[7, 11, 12] advocate using steroids in conjunction with antituberculous medication.

2. One case, suspected of brucellosis, received aureomycin and dihydrostreptomycin.

3. A fifth case, showing repeated vitreous hemorrhages, proliferating retinitis, and acute chorioretinal lesions received intravenous typhoid therapy.

Generally speaking, this group was erratic in its reactions to steroid therapy, as compared to the nongranulomatous group.

Correlation between medical therapy and clinical results

Granulomatous group (table 1)

Five days of therapy. Average total dose of triamcinolone: 119.2 mg. In five cases there was a very slight decrease in anterior chamber activity, just a perceptible decrease in the perifocal subretinal edema, and some decrease in the elevation of the lesion.

Ten days of therapy. Average total dose of triamcinolone: 217.2 mg. In eight cases, the anterior chamber had cleared. The eye was white, with marked decrease in subretinal edema around the lesion. The lesion was flatter and more demarcated but the vitreous haze was still marked. One case (D. H., No. 6 table 1) showed no signs of improvement. O.S., repeated hemorrhages (retinal and vitreous). Rete rapidly spreading into vitreous (retinitis proliferans).

Fifteen days of therapy. Average total dose of triamcinolone: 298 mg. Six cases showed progressive cicatrization and flattening of the posterior lesion. The anterior chamber was clear. Two cases showed signs of renewed anterior segment activity.

Thirty days of therapy. Average total dose of triamcinolone: 379 mg. There was complete remission in six cases. The posterior lesion was flat and mildly pigmented. Three cases showed anterior segment exacerbations.

Sixty days of therapy. Average total dose of triamcinolone: 437 mg. Six cases presented quiescent eyes. Posterior lesions were well cicatrized, with slightly pigmented margins. Two cases (F. C., No. 8 and E. G., No. 5, table 1) still showed signs of anterior chamber activity.

One hundred and twenty days of therapy. Average total dose of triamcinolone: in two cases, 747 mg.; in all other cases: 437 mg. Seven cases were quiescent; two cases received an additional 30 to 40 days of therapy.

One hundred and sixty days of therapy. Average total dose of triamcinolone: 747 mg. Both of the refractory cases just mentioned responded to additional therapy.

In view of the particularly mild pigmentation in the healed lesions of the posterior segment, it is of interest to refer to the paper by Gordon, et al.[5] who commented that "acute choroidal lesions tend to heal with fragmentation rather than shrinkage and pigmentation, such as follows nonsteroid therapy or no therapy at all. Vitreous exudation is prevented or cleared and, since pigmentation is slight, the healed zones have a peculiar smeared appearance."

Nongranulomatous group (table 2)

Five days of therapy. Average total dose of triamcinolone: 113 mg. Four cases showed a perceptible decrease in anterior chamber activity. Four cases maintained the status quo, and one case showed increased activity.

Ten days of therapy. Average total dose of triamcinolone: 182 mg. In five cases there was complete remission. Four cases were quiescent, with residual old crenated keratic precipitates being noted.

Fifteen days of therapy. Average total dose of triamcinolone: 227 mg. In three cases, the eyes were white, with no activity. One case (M. A. No. 5, table 2), one of postkeratoplasty uveitis, showed marked vascularization of the cornea and graft; however, signs of inflammatory activity were absent. Following an additional month of therapy, her vision improved from: O.D., 20/200 (uncorrected) to 20/50 (corrected).

In general the treatment of the uveitis with herpes zoster has been discouraging; however, in our series, two cases of herpes zoster responded to steroids, confirming the

findings recently reported by Scheie and Alper[17] who cited seven authors who had used steroids with good results in this condition.

Pharmacology of triamcinolone

Triamcinolone, a fluorinated steroid, has important properties which are quantitatively and qualitatively different from those of other steroid compounds.

Anti-inflammatory activity

Triamcinolone, by ingestion has marked anti-inflammatory activity,[4] the maximum suppression of posterior lesion activity appearing between the seventh to the 10th day. This interval apparently represents the time required for the completion of two processes: ". . . suppression of the current inflammation and the subsequent removal of accumulated products. . . ."[18] Clearing of the anterior segment, on the average, took five to seven days in the nongranulomatous group, and seven to 10 days in the granulomatous group. Several cases in this latter group showed a marked tendency to recurrent flare-ups.

Eosinopenia

There appears to be a correlation between "organic metabolic-regulating" effects and "anti-inflammatory" activity. West[19] indicates that the eosinopenic potency of triamcinolone is significantly greater than that of prednisolone.

Patients in our series showed prompt but variable eosinopenia upon administration of triamcinolone.

Diabetogenic action

With the advent of the newer steroids, it became apparent that, contrary to previous evaluations, there, in all probability, exists a disparity in the relationship between the anti-inflammatory and carbohydrate activity of a given steroid. Furthermore, "steroid diabetes" is quite different, both in its chemical aspect and biochemical reactions, from "pancreatic diabetes." It has been shown that hypercorticism is not common among patients with diabetes mellitus; also that "steroid diabetes" is rare among patients treated with large doses of adrenal steroids; and that "steroid diabetes" is reversible.[3]

The ability of steroids to prevent severe hypoglycemia is not necessarily a function of their effect on the level of the blood-sugar; their effect probably lies on the transport of glucose or its utilization by the brain. The problem remains to ascertain whether the effects on the carbohydrate metabolism are due to the steroids or to the suppression of the endogenous hormone.[8]

West[17] reports that his data suggest that the hyperglycemic potency of triamcinolone is significantly greater than that of prednisolone and five times that of hydrocortisone. Kupperman, et al.[9] suggest the same in their report of an increase in blood-sugar level by 15 to 20 percent two hours after administration of triamcinolone.

In the two cases with hyperglycemia in our series one case (F. C. No. 8, table 1) underwent extensive investigation and eventually was put on Orinase therapy. In both cases the blood-sugar level returned to normal after cessation of steroid therapy.

Weight loss

There was a gradual decrease in body weight under Kenacort therapy, averaging between two to three pounds. After cessation of therapy, there was a general trend to a return to the original weight. Kupperman[10] believes the loss of body weight apparently is due to a combination of several factors—a complete lack of sodium retention, a lesser appetite-stimulating action than other steroids, and finally, to muscle wasting.

Electrolyte metabolism

Adrenal steroids may cause Na + retention by increasing its tubular reabsorption from the glomerular filtrate by a cation-exchange process in which K +, H +,

TABLE 1

GRANULOMATOUS U

Name & Case No.	Age (yrs.)	Sex	Color	Past History	Present History	Anterior Segment	Posterior Segment	Significant Laboratory Tests	Clinical Tests	Total Dosage		5 Day
										Kenacort	Adjuvant	
C.C. 1	36	F	W	Rheumatic heart disease at 11 yr.	Progressive blurring of vision and "black spots" in O.D. for the past month	V.O.D. 20/30 V.O.S. 20/20 Eye: white K.P. ....2+ Flare ....1+ Cells ....1+	Vitreous haze ....3+ Lesion: active elongated in inferior periphery, 4–8 o'clock. 1½ dd × 6 dd.	Mantoux ....1+ (1:1,000)	Lower jaw: carious teeth Perimetry: superior field defect	368 mg.	—	(120 mg.) K.P. .... Flare .... Cells .... Vitreous haze .... Lesion: no cha
S.F. 2	16	F	W	Noncontributory	O.D. blurred vision since childhood. Under constant control. Exacerbation of "black-spots" for past three da.	V.O.D. 10/200 V.O.S. 20/20 O.D. anterior chamber is clear	O.D. vitreous haze ....2+ Old chorio-retinal lesion in macular area. Active elevated lesion contiguous 1 dd × 1 dd. Surrounding subretinal edema ....2+	Toxoplasmosis skin test: Neg.	Perimetry: scotoma in para-central field corresponding to site of lesion	600 mg.	PAS: 556 gm. Rimifon 900 mg.	(128 mg.) V.O.D. 10/20 Lesion: much fl Vitreous striae
I.A. 3	22	F	W	Noncontributory	O.S. gradual and progressive onset of "black-spots" and blurring of vision for past 3 da.	V.O.D. 20/30+3 V.O.S. 20/200 O.S. ciliary flush ....3+ Corneal edema ....1+ K.P. ....3+ Flare ....3+ Cells ....3+ Pupillary seclusion	O.D. vitreous haze ....3+ Macular edema ....2+ Active elevated chorioretinal lesion, below and lateral to the macula. Massive exudate. Retinal striae radiate from lesion. Venous congestion	Brucellosis ...1+	Chronic tonsillitis	308 mg.		(104 mg.) V.O.S. 20/20 K.P. .... Flare .... Cells .... Vitreous haze .... Post. lesion rai
C.Y. 4	11	F	W	Chronic pharyngitis every winter	Complaint of chromatopsia and progressive blurring of vision in O.S. for the past month	V.O.D. 20/20 V.O.S. 20/200 cc. O.S. ciliary flush ....3+ K.P. (mutton-fat) ....3+ Flare ....3+ Cells ....3+ Koeppe nodules ....3+ Bussaca flocculations ....3+	O.S. vitreous haze ....3+ Active, elevated chorioretinal lesion lying temporarily to macular region about 3 dd. away from it. Approximately 2 dd. ×2 dd. Macular edema and "star"	Brucellosis ...1+	Culture of gastric lavage & sputum for Tbc: negative	414 mg.	PAS: 196 mg. INH: 4.4 gm.	(112 mg.) V.O.S. 20/20 A.C.: clear Lesion: flatter cated. Less edema. Macular edema
E.G. 5	44	M	W	Noncontributory	Since 3/9/58 has had recurrent uveitis. Since past two months blurring of vision has gradually increased	V.O.D. 20/20 V.O.S. H.M. O.S. hypertensive uveitis Ciliary injection ....3+ Bullous keratitis ....3+ Corneal edema ....3+ K.P. (mutton-fat) ....3+ Flare ....3+ Cells ....4+ Koeppe nodules and Bussaca flocculations ....2+ Posterior synechiae ....3+	Clear!!	Noncontributory	Mantoux (1:10,000) 24 hr.: ....1+	700 mg.	PAS: 960 mg. INH: 7.5 gm. Strept.: 7 gm. Diamox: 7.500 mg.	(120 mg.) V.O.S. 20/40 T. Schiotz: od: 12 mm.H os: 33 mm.Hg K.P. .... Flare .... Cells .... Koeppe nod...
D.H. 6	44	F	C	1953 facial paresis, complete recovery. 1956 bilateral cervical adenitis, spontaneous resorption. 1958 typhoid fever	Onset of blurred vision and recurrent uveitis since 1951. Had been hospitalized four times during 1958. Constant aggravation of her condition	V.O.D. H.M. V.O.S. Light perception O.U. K.P. (mutton-fat) ..3+ Flare ....3+ Cells ....3+	O.D. multiple desseminated flame-shaped and rounded hemorrhages. Much exudate, Proliferating retinitis in nasal fundus, near periphery. Vitreous haze ....4+ O.S. fundus not visualizable. Many vitreous floaters. Large mass of proliferative tissue discernible in lower part of vitreous tissue	Noncontributory	Mantoux (1:100,000) 24 hr.: ....2+ Febrile agglutination tests: Typhoid "O" (1/80) .4+ "Moon-faced," swollen ankles. Hepatomegaly Bone-marrow: neg.	750 mg.	Chloromycetin: 7.5 gm.	(120 mg.) V.O.D. 20/30 V.O.S. H.M. K.P. "mutton-f Flare .... Cells .... Vitreous haze .... Lesion: raised Sub-retinal ede Condition mor tuated in O.S
H.W. 7	38	F	W	Noncontributory	Sudden onset of blurred vision for the past wk. in O.D.	V.O.D. 8/200 V.O.S. 20/30 O.D. K.P. (mutton-fat) ..3+ Flare ....3+ Cells ....3+	O.D. vitreous haze ....3+ Active chorioretinal lesion lying below and temporarily to the macula. In its vicinity lies an old cicatrized chorioretinal lesion. Active lesion is slightly elevated, and is approximately 3 dd. ×2 dd.	Blood-sugar 131 mg.%	Culture of left sphenoidal sinus washings: Aerobact. aerog. Hem. Staph. aureus	580 mg.		(120 mg.) V.O.D. 20/100 V.O.S. 20/30 O.D. K.P. .... Flare .... Cells .... Vitreous haze .... Lesion elevation
F.C. 8	54	F	W	Osteorheumatic arthritis of hands. Steroid diabetes?	Recurrent attacks of visual blurring since 1957. Had undergone prolonged steroid therapy prior to being referred to N.Y.E.E.	V.O.D. 20/40+3 V.O.S. 20/30−2 O.U. ciliary flush ....2+ K.P. (mutton-fat) ....2+ Flare ....3+ Cells ....3+	O.S. vitreous haze ....3+ Elevated lesion of the choroid and retinal tissues. Liestemporarily to the macula, circumscribed by sub-retinal edema ....3+ Lesion is approximately: 2 dd. ×3 dd. Macular edema	Boold-sugar 138 mg.%	Osteo-rheumatic arthritis in both hands. Infected nasopharyngeal cyst. Diabetes. Brucellosis ....1+	518 mg.	Orinase	(120 mg.) V.O.D. 20/40 V.O.S. 20/50 Ciliary flush .... K.P. .... O.S.: Poster. syn echias ....
A.I. 9	24	F	W	Noncontributory	"Black spots" since 3 da.	V.O.D. 20/30 V.O.S. 20/20 O.D. K.P. (mutton-fat) ..3+ Flare ....3+ Cells ....3+ Koeppe nodules ....2+ Descemet folds ....2+	O.D. vitreous haze ....2+ Blurred margins of optic disc chorioretinal lesion of about 2 dd. × 2 dd. lies temporal to the macular region. Circumscribed by subretinal edema. Thin streak of pigment contours lower margin of lesion	Noncontributory	Brucellosis (48 hr.) ...4+	336 mg.	Aureomycin *13 gm.* Di-hydro-streptomycin *7 gm.*	(100 mg.) V.O.D. 20/30 V.O.S. 20/20 Vitreous haze .. Lesion in regres
L.V. 10	46	F	W	Noncontributory	O.D. floaters and an old cicatrized chorioretinal lesion had been diagnosed 9 mo. ago "Black spots" have increased	V.O.D. 20/50 V.O.S. 20/40 O.D. K.P. ....3+ Flare ....2+ Cells ....2+	O.D. vitreous haze ....5+ Fundus very poorly visualized An active lesion can be just made out, lying near an old cicatrized chorioretinal lesion. Active lesion is elevated and yellowish in color Approximate size 3 dd × 2 dd	Several carious teeth	Noncontributory	684 mg.		(148 mg.) V.O.D. 20/40 V.O.S. 20/20 O.D.: K.P. .... Flare .... Cells .... Lesion flatter
E.O. 11	62	M	W	Noncontributory	Recurrent uveitis for past 30 yr. Was hospitalized several times for said condition. Acquired hypertensive uveitis, was operated on. O.S. became amaurotic	V.O.D. 20/70 V.O.S. Light perception O.D. shallow anterior chamber. Anterior peripheral synechias K.P. (various sized, crenated) ....4+ Atrophic, vestiges of iris tissue. Intense photophobia	O.D. posterior synechias Epicapsular pigment deposits. Vitreous haze ....4+ Cyclitic membrane in vitreous. Desseminated chorioretinitis. Proliferating retinitis in lower retinal periphery. Pale disc, narrow vessels. No signs of active lesion	Pandy: positive Gold colloid curve: positive for syphilis	Mantoux ....1+ (1:10,000)	388 mg.	Penicillin: 12 million	(80 mg.) Photophobia .... K.P. (Old) .... Fundus: idem.

BLE 1

IATOUS UVEITIS

5 Days	10 Days	15 Days	30 Days	60 Days	120 Days	Effects Upon Metabolism	Side-Effects	Comments
ng.) .....1+ .....1+ .....1+ us haze.....3+ : no change	(+100 mg.) V.O.U. 20/30 Vitreous.....1+ Lesion: demarcated. Ret. edema.....1+	(+37 mg.) Status quo	(+37 mg.) Lesion: progressive pigmentation	(+74 mg.) Pigmentation of lesion has increased			Rash appeared all over her body. Disappeared spontaneously within 1 wk.	Marked improvement. Patient did not show up for follow-up study
ng.) . 10/200 : much flatter. us striae appeared	(+104 mg.) V.O.D. idem. Lesion: still flatter	(+74 mg.) Onset of pigmentation. Vitreous striae.....2+	(+120 mg.) Pigmentation increasing. Vitreous striae..1+	(+176 mg.) Lesion is flat and very pigmented		No change in electrolytes Eosinopenia Decrease in sedimentation rate	Moon-faced about the 60th da. of therapy. No change in body weight	Complete healing. Moon-face persisted for a week or so
ng.) 20/200 .....2+ .....3+ .....3+ us haze.....3+ esion raised...2+	(+68 mg.) Visus: idem. K.P.....2+ Flare.....2+ Cells.....2+ Vitreous haze.....2+ Lesion well circumscribed	(+56 mg.) V.O.S. 20/40−1 Lesion flat, slightly pigmented	(+100 mg.) Vitreous haze.....1+ Visus: idem. Lesion quiescent		Lesion quiet, well healed, pigmented. Vitreous haze+ Macular stippling	Eosinopenia Decrease in sedimentation rate	Decrease in body weight	Complete healing
ng.) 20/200 clear : flatter demard. Less retinal na. ar edema.....2+	(+90 mg.) Onset of pigmentation	(+68 mg.) Lesion flat pigmented. Macula mottled, pigmented. Striae still present	(+84 mg.) Lesion well demarcated. Vitreous much clearer. Lesion & macula pigmented	(+60 mg.) Lesion quiet, well healed V.O.S. 20/200		Eosinopenia Decrease in sedimentation rate	Appearance of "moon-face" about 40 days posttherapy. During therapy, had lost some weight	Complete healing
ng.) 20/40 iotz: 12 mm.Hg 3 mm.Hg .....2+ .....2+ .....2+ e nod.....2+	(+120 mg.) Vision idem. K.P.....1+ Koeppe.....1+ T.O.S.: 33 mm.Hg	(+80 mg.) K.P. (Crenated)....1+ Koeppe.....1+ T.O.S.: 30 mm.Hg	(+60 mg.) Flare-up.....!! K.P.....3+ Flare.....3+ Cells.....3+ Corneal edema....3+ T.O.S.: 41 mm.Hg Peri-orbital contact-dermatitis	(+120 mg.) K.P.....1+ Flare.....1+ Cells.....1+ V.O.S. 20/30 T.O.S. =30 mm.Hg	180 days (+480) A.C. clear V.O.S. 20/30 T.O.S. =30 mm.Hg	Eosinopenia Decrease in sedimentation rate	Toward the end of therapy, some rash appeared over face	Multiple incidences of flare-ups. Final healing; no further incidence since three mo.
g.) 20/30 H.M. mutton-fat" .3+ .....3+ .....3+ us haze.....5+ : raised tinal edema..4+ ion more accened in O.S.	(+120 mg.) O.D. vitreous haze .1+ Lesion well demarcated. O.S. Vitreous haze..2+ Proliferating retinitis	(+85 mg.) V.O.D. 20/40 V.O.S. 5/100 O.D. Lesion flatter. O.S. Vast preretinal hemorrhage	(+65 mg.) Flare-up! O.D. Flare.....3+ Cells.....3+ Vitreous haze.....3+ O.S. Flare.....3+ Cells.....3+ Vitreous haze.....5+	(+280 mg.) *O.D.* K.P.....2+ Flare.....2+ Cells.....2+ Vitreous haze:....4+ Lesion raised active.....4+ *O.S.* K.P.....3+ Flare.....2+ Cells.....2+ Vitreous haze:....5+ Prolifer retinitis 4+	(+180) O.U. Violent flare-up. Hemorrhagic diathesis. Prolif. ret	Eosinopenia	Moon-faced, swelling of ankles. Sensation of swelling in nasopharynx	Vision deteriorated
g.) 20/100 20/30 .P.....1+ .....2+ .....2+ s haze.....2+ elevation....3+	(+100 mg.) Visus: idem. O.D.: Ant. cham.: .....clear Vitreous haze.....1+ Lesion well demarcated	(+80 mg.) V.O.D. 20/50 V.O.S. 20/30 Lesion flatter and demarcated	(+60 mg.) V.O.D. 20/50 V.O.S. 20/25 *FLARE-UP!!* Ciliary flush.....1+ Vitreous haze.....2+ Lesion quiet, onset of pigmentation		120 Days (+220 mg.) V.O.D. 20/50 V.O.S. 20/20 O.D. Lesion flat & pigmented	Eosinopenia Decrease in sedimentation rate		Complete healing
g.) 20/40 20/50 flush.....1+ .....1+ oster. syn- s.....3+	(+100 mg.) A.C.: clear Lesion: flatter, demarcated	(+80 mg.) V.O.U. 20/40 *Flare-up!!* Ciliary flush.....1+ Onset of pigmentation of lesion	Vision: idem. Lesion shows increased pigmentation	(+180 mg.) Ciliary injection...1+ V.O.U. 20/40		Eosinopenia Decrease in sedimentation rate High blood sugar level	Steroid induced diabetes. Cleared up on cessation of steroid administration. Petechial hemorrhages over forearms on 60th da. of therapy	Complete healing
mg.) 20/30 20/20 s haze.....1+ in regression	(+100 mg.) O.U.: Visus idem. Onset pigmentation of lesion. Center of lesion is active	(+100 mg.) Visus idem. Lesion flat demarcated, quiet and pigmented		(+36 mg.) V.O.U. 20/20 O.D. Lesion quiet, pigmented		Eosinopenia Decrease in sedimentation rate	Skin eruption (rash) appeared about 5 da. after cessation of therapy. Loss in body weight	Complete healing
.) 20/40 20/20 .P.....1+ .....1+ .....1+ latter	(+76 mg.) Visus: idem. Lesion smaller, demarcated. Onset pigmentation	(+76 mg.) V.O.D. 20/40 O.D.: Lesion well pigmented		(+120 mg.) V.O.U. 20/20 Lesion well pigmented	(+360 mg.) Lesion quiet	Eosinopenia	No loss in body weight	Complete healing
) hobia.....3+ d).....2+ idem.	(+100 mg.) No change in condition	(+108 mg.) O.S.: K.P. persist.....3+ Vitreous haze.....3+ Cyclitic membrane..3+	(+100 mg.) O.S.: K.P.....1+ Cyclitic membrane .2+ Fundus idem.	(+208 mg.) K.P.....4+ Flare.....2+ Photophobia idem. Vitreous.....1+	Condition idem. Photophobia disappeared. Less K.P.			Subjectively improved

TABLE
NONGRANULOMATO

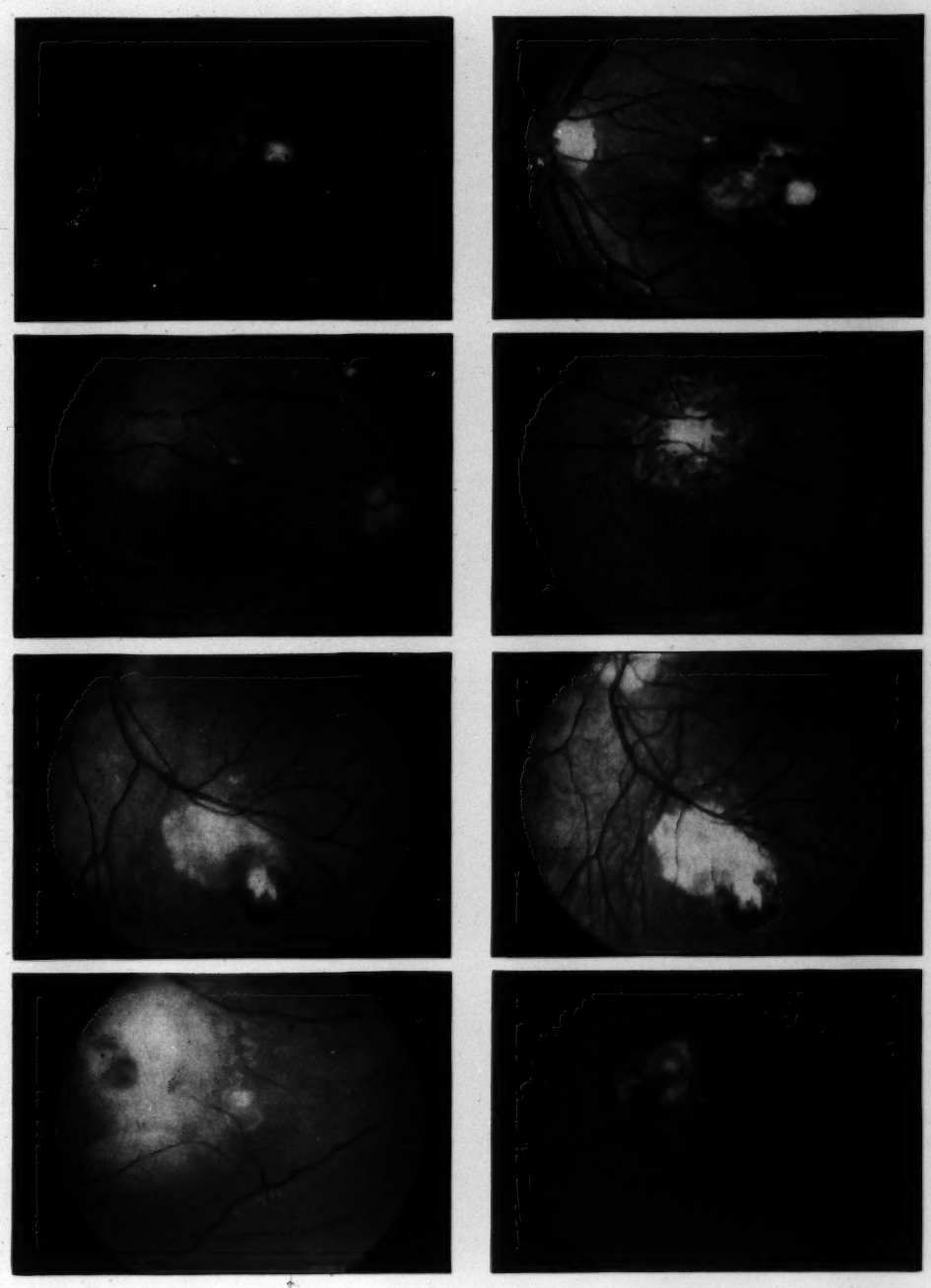
Name	Age (yr.)	Sex	Color	Past History	Present History	Anterior Segment	Posterior Segment	Significant Laboratory Tests	Clinical Tests	Total Dosage	
										Kenacort	Adjuvant
A.C. 1	48	F	W	Noncontributory	Gradual and painful onset with blurring of vision in O.D. and headaches for past 2 wk.	V.O.D. 20/200 cc. 20/50 V.O.S. 20/200 cc. 20/50 O.D. Ciliary flush....3+ K.P.....3+ Flare.....3+ Cells.....3+	O.D. vitreous haze, 1+, healed chorioretinal lesion in temporal periphery of fundus. No active lesions seen	Noncontributory	Brucellosis (96 hr.) .....1+	262 mg.	—
C.R. 2	22	F	W	Poliomyelitis 1949, paraplegia. Complete recovery. Chronic left maxillary sinusitis	Sudden onset of blurred vision in O.D. upon awakening one morning 1 wk. ago	V.O.D. 20/40 V.O.S. 20/20 O.D.: Eye white K.P.....3+ Flare.....2+ Cells.....2+	O.D. vitreous haze, 3+, no fundal lesions seen	Culture of left antrum washings: negative noncontributory	Mantoux.....2+ (1:10,000) Brucellosis..... ± (98 hr.)	489 mg.	Combiotic 18 cc.
K.S. 3	39	M	W	Had left-sided herpes zoster 1 wk. prior	Sudden onset of blurred vision following a painful vesicular eruption over left side of face and lids 1 wk. prior	V.O.D. 20/20 V.O.S. 20/30 O.S. vesicular eruption over both eye-lids Localized ciliary flush at 12.00. 1+	Clear	Noncontributory	Noncontributory	560 mg.	—
J.G. 4	10	M	W	Three months ago had penetrating wound, O.S. operated on for traumatic cataract and lesion repaired	O.S. traumatized again, hit by a ball, 1 da. prior	V.O.D. 20/20 V.O.S. 20/70 cc. O.S. hypotonic globe Ciliary flush.....3+ Flare.....4+ Cells.....4+	Clear	Noncontributory	Noncontributory	156 mg.	—
M.A. 5	50	F	W	Atypical Fuchs' epithelial dystrophy; history of same condition in three consecutive generations. About 40% of siblings affected	O.S. six months after penetrating keratoplasty, sudden onset of pain for past 5 da.	V.O.D. H.M. V.O.S. 20/200 O.D. Palpebral edema.....1+ Ciliary injection.....3+ Graft: Epithelial edema & endothelial folds.....4+ Cornea: Infiltrated & very vascularized.....4+ Endothelial folds.....1+ Epithelial edema.....2+ K.P.....1+	Clear	Noncontributory	Chronic tonsillitis		320 mg.
E.H. 6	68	F	W	Had pyelonephritis. Left-sided herpes zoster ophthalmicus with hypertensive uveitis	O.S. three weeks after onset of herpes zoster, 2nd glaucoma developed	V.O.D. 20/20 V.O.S. H.M. O.S. periorbital & palpebral crusts K.P.....2+ Flare.....2+ Cells.....2+ Gonioscopy: Much debris in angle. Open angle	Vitreous haze, 3+, no fundal lesions seen	Noncontributory	Tonography: K value is high, due to hypersecretion Open angle; filled with debris		200 mg.
R.B. 7	33	M	W	Gonorrhea in 1943	O.S. three days after contusion to eye & orbit, onset of pain and blurring of vision	V.O.D. 20/30 V.O.S. 20/40 O.S.: Conjunctival hyperemia.3+ Punctate keratitis.....3+ Flare.....3+ Cells.....3+ Several concentric tears of iris tissue Ciliary injection.....3+	Macular edema, 2+, no other fundal lesions seen	Initially high sed. rate: 36 mm./hr.	Noncontributory		80 mg.
E.P. 8	50	F	W	Noncontributory	O.S. recurrent uveitis since childhood. 4 attacks since 1951. Blurred vision since 24 hr.	V.O.D. 20/50 cc. 20/30 V.O.S. 20/50 cc. 20/30 O.S. conjunctival hyperemia Ciliary injection.....2+ K.P.....2+ Flare.....2+ Cells.....2+	O.S. macular edema, 1+	Initially high sed. rate: 22 mm./hr.	Brucellosis 48 hr. .....2+	374 mg.	—
L.R. 9	38	F	W	Allergic predisposition	O.S. one week after trauma to left temporal and periorbital regions, onset of deep ocular pain and photophobia	V.O.D. 20/20 V.O.S. 20/20 O.S. extensive ecchymosis of temporal and periorbital regions Ciliary injection.....2+ K.P.....2+ Flare.....4+ Cells.....4+	O.S. posterior synechias, 2+, no fundal lesions	Initially high sed. rate: 36 mm./hr.	Noncontributory	156 mg.	—

TABLE 2
LOMATOUS UVEITIS

sage / ljuvant	5 Days	10 Days	15 Days	30 Days	60 Days	120 Days	Effects Upon Metabolism	Side-Effects	Comments
—	V.O.U. 20/50 cc. O.D.: K.P.....1+ Flare.....2+ Cells.....2+ (120 mg.)	(+80 mg.) O.D. Flare..... + Cells..... +	(+56 mg.) V.O.D. 20/40 cc. O.D.: clear	(+32 mg.) O.D.: clear	(+30 mg.) V.O.D. 20/40 O.D.: quiet		Eosinopenia. Decrease in sedimentation rate	Decrease in body weight. Onset of rash in axillary regions, 30 days after cessation of steroid therapy	Complete healing
mbi- otic 18 cc.	(120 mg.) V.O.D. 20/50 V.O.S. 20/20 No amelioration	(+98 mg.) V.O.D. 20/50 O.D.: K.P..... + Vitreous haze.....2+ Marked improvement	(+40 mg.) Very few crenated K.P.s Vitreous haze..... +	(+38 mg.) V.O.D. 20/50 O.D.: Vitreous haze +	(+60 mg.) V.O.D. 20/50 O.D.: anterior chamber & vitreous are clear	(+130 mg.) V.O.D. 20/40 O.D.: clear	Decrease in sedimentation rate	None	Complete cure
—	(120 mg.) O.S.: Ciliary injection..1+ Small vesicle at 12.00...1+ V.O.D. 20/20 V.O.S. 20/30	(+100 mg.) V.O.S. 20/30 Clear!!		(+75 mg.) Flare-up O.S. Ciliary flush..2+ Corneal lesions at 9-, 12-, 3-o'clock	(+230 mg.) V.O.S. 20/30 O.S. corneal infiltration.....1+	(+55 mg.) V.O.S. 20/30 O.S.: faint nebulae. Eye quiet	—	—	Complete cure
—	(60 mg.) V.O.S. 20/70 cc. Flare.....1+ Cells.....1+ Photophobia	(+32 mg.) Eye: white	(+32 mg.) Eye quiet V.O.S. 20/70 cc.	(+32 mg.) V.O.S. 20/70 cc. Eye quiet	V.O.S. 20/20 cc. O.S.: Eye: quiet	—	—	—	Complete cure
0 mg.	Diamox 3.75 gm.	(104 mg.) V.O.D. H.M. Graft & cornea: endothelial edema.....1+ Folds of Descemet.....1+ Pannus.....1+ Flare.....1+	(+72 mg.) Edema & Pannus.....1+	(+40 mg.) Status idem.	(+36 mg.) V.O.S. 15/200 O.S.: slight endothelial edema of graft. Pannus tenuis	—	—	—	Complete cure
0 mg.	Diamox 3.75 gm.	(120 mg.) V.O.D. 20/20 V.O.S. H.M. K.P. (Old).....1+ Vitreous haze.....1+	(+80 mg.) V.O.S. 20/80 O.S.: K.P.....1+ T. Schiøtz: O.D.: 9 mm.Hg O.S.: 13 mm.Hg		—	—	—	—	Complete cure
0 mg.	—	(54 mg.) V.O.D. 20/20 V.O.S. 20/30 O.S.: Ciliary flush.....1+ Flare.....1+ Cells.....1+ Fundus: clear	(+16 mg.) V.O.S. 20/20 O.S.: clear	(+10 mg.) V.O.U. 20/20 O.S.: clear	—	—	—	—	Complete cure
—	(120 mg.) V.O.S. 20/50 cc 20/30 O.S.: K.P.....1+ Flare.....1+ Cells.....1+	(+100 mg.) O.S.: K.P.....1+ Flare.....1+ Cells.....1+	(+100 mg.) O.S.: clear V.O.U. 20/30 cc.		—	—	—	—	Complete cure
—	(116 mg.) V.O.S. 20/20 Posterior synechiae: ruptured Eye: quiet	(+40 mg.) V.O.S. 20/20 Eye: quiet			—	—	—	—	Complete cure

PLATE I

BEFORE AFTER



Top: S. F., Case 2, Table 1

Top center: C. Y., Case 4, Table 1

Bottom center: H. W., Case 7, Table 1

Bottom: A. L., Case 9, Table 1

PLATE II

AFTER

BEFORE

M. A., Case 5, Table 2

NH_4 + are secreted into the tubular urine. Cortisone markedly exhibits such electrolyte-regulating potentials. However, there is abundant evidence that, in the newer synthetic steroids, there is a marked disparity between increased anti-inflammatory activity and electrolyte-regulating action.[14] Our series of cases showed no significant alterations in the blood electrolytes throughout triamcinolone administration.

Dermatoses

Prolonged administration may produce cutaneous side-effects that are peculiar to triamcinolone. This reaction is often manifested by erythema or acnelike eruptions which are sometimes accompanied by increased perspiration in the region of the face, neck, and thorax.[3] Four patients in our series showed erythematous eruptions.

Other undesirable effects considered to be of greater incidence in triamcinolone therapy are easy bruising, ecchymosis, and purpuric rash. One of our cases (F. C. No. 8, table 1), in which "steroid diabetes" was present, showed multiple ecchymoses and a purpuric rash shortly after cessation of steroid administration.

Erythrocyte sedimentation rate

Our series confirmed the findings in other studies on triamcinolone therapy that: (a) there is a prompt decrease in sedimentation rates, (b) the variations in the sedimentation rate do not of necessity parallel the clinical reponse of the patient, and (c) upon discontinuation of triamcinolone therapy, the sedimentation rate generally rises again.

Lymphoid system response

Dissolution of lymphoid tissue and lymphopenia have been reported to occur with steroid therapy.[18] There is a suppression of circulating lymphocytes and a concurrent rise in neutrophils, without changes in the total leukocyte count. Our findings did not confirm these hematologic studies.

Moon facies and buffalo humping

A rounded face and increased deposition of fat in the supraclavicular and upper dorsal regions were noted to a variable extent in three cases (Nos. 4, 6, and 8, table 1). Because the degree of facial swelling was minimal, cessation of treatment was not necessary. In general, there was only a suggestion of thickening noted about the lower aspect of the face. One patient (No. 8, table 1), who had undergone six months of previous (steroid) treatment, presented a cushingoid appearance that did not decrease under triamcinolone therapy. None of the cases had arterial hypertension, and only two had high blood-sugar levels (No. 7 and No. 8, table 1) but no glycosuria, two features commonly associated with Cushing's syndrome.

Hirsutism

This problem was not encountered among the patients we studied.

Epigastric distress and peptic ulceration

Neither were these conditions encountered in our series.

Comment

Twenty cases of uveitis, granulomatous and nongranulomatous, were studied and treated with a new steroid preparation, Kenacort® (triamcinolone), Squibb. Recovery was noted in 18 cases of which eight had adjuvant therapy. Exacerbations were noted in five cases of granulomatous uveitis. These cases promptly responded to increased doses of Kenacort. Though Kenacort did not cause sodium retention or edema, or produce gastrointestinal disturbances, it had certain side-effects which are apparently peculiar to itself, such as erythematous eruptions, ecchymoses, loss of body weight and diabetogenic potency. There are other side-effects listed in various reports, such as fatigue and muscle cramps, that were not en-

countered in our series. Only one case, which had been under previous steroid therapy, showed side-reactions to an extent that necessitated cessation of therapy. Kenacort has a number of features that make it a desirable agent in the therapy of uveitis. Satisfactory results were obtained in the cases in our series which had shown unsatisfactorily response to previous steroid therapy.

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BIOMICROSCOPIC EXAMINATION OF THE FUNDUS WITH A +55D. LENS

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The possibilities of the +55D. lens used with the new biomicroscopes are infinite and as yet unexplored. The employment of this lens was first suggested by El Bayadi in 1953[1] and again in 1954.[2] It appears to have much greater value than does the Hruby lens (−55D.) but for reasons unknown it has engendered very little attention among American biomicroscopists.

In a recent article Pischel[3] has stated "the

ability to make a good slitlamp examination of the fundus is an absolute necessity in the practice of clinical ophthalmology." Unfortunately, Pischel has not mentioned the convex lens (+55) although he does list the advantages of the preset Hruby lens and the mirrored contact lens (Goldmann).

This omission appears significant since his paper is a plea for routine biomicro-ophthalmoscopy, and yet the most versatile and most valuable technique is not mentioned. However, it should be pointed out that in the recent treatise by Busacca, Goldmann and Schiff-Wertheimer[4] upon the biomicroscopic examination of the vitreous and the fundus, very little space is devoted to this lens in the 373 pages of the monograph.

Goldmann raises the objection that this plus lens requires a greater space between the examined eye and the microscope than does the Hruby lens and that the present biomicroscopes do not allow for this increased spatial difference. It is the purpose of this paper, therefore, to familiarize those interested in this method of examination of the fundus, through pointing out its many advantages, so that it may rightly take its place at the head of the list of the various armamentaria employed in studies upon retinal detachment. Since this examination may be done without further expense and without any "gadgets," it should be most appealing.

For those interested in the physiologic optics of this problem, reference is again made to the original articles of El Bayadi, where the advantages of this lens over the Hruby glass, are described. Another article which discusses the various lenses from the standpoint of physiologic optics is that by H. Rotter.[5]

The method is actually a form of indirect ophthalmoscopy using a slitbeam and the binocular microscope, thus permitting depth, magnification and stereopsis. The patient should be comfortably seated before the biomicroscope with the chin and head immobilized. Handlebars are advocated as included in the newer Zeiss instruments so that the patient may have proper support and a place to rest the hands. Indeed the handlebars appear to be rather essential to produce permanent head fixation, for through this device the patient is enabled to press the chin and head against the proper supportive elements through forward propulsion created by the manual pull.

A most important adjustment which permits one to see the fundus clearly is brought about by increasing the distance between the patient's eye and the microscope some three or four inches. In the Zeiss microscope this may be accomplished by moving the chin rest as far away as possible from the microscope (fig. 1); in the case of the Goldmann slitlamp this is accomplished by moving the microscope backward as far as it can go in the direction of the examiner (fig. 2).

Although there is no provision in the present biomicroscopes, an instrument which would permit the patient's head to be rotated 30 degrees to the right or to the left is very desirable for study of the periphery of the fundus. This degree of rotation, however, can be secured by just turning the patient's head to the right or left as desired.

As stated by El Bayadi "the angle between the lamp and the ocular should be reduced to not more than 10 degrees" and for this reason the new Zeiss instrument offers much greater facility in the performance of biomicro-ophthalmoscopy. A (+55) or (+60) lens is held in front of the eye to be examined. This may be obtained most readily from the proximal portion of one of the eyepieces of any microscope.

I have used several lenses of slightly different diameter and dioptric power. The lens may be taken from the eyepiece of the ordinary microscope or from one of the older slitlamps. The anterior cell usually marked 6×; 8× or 10×, may be unscrewed from the eyepiece. I have had a (+55) biconvex lens made by the American Optical Company, but this does not perform as well, because of the highlights and reflexes created by the

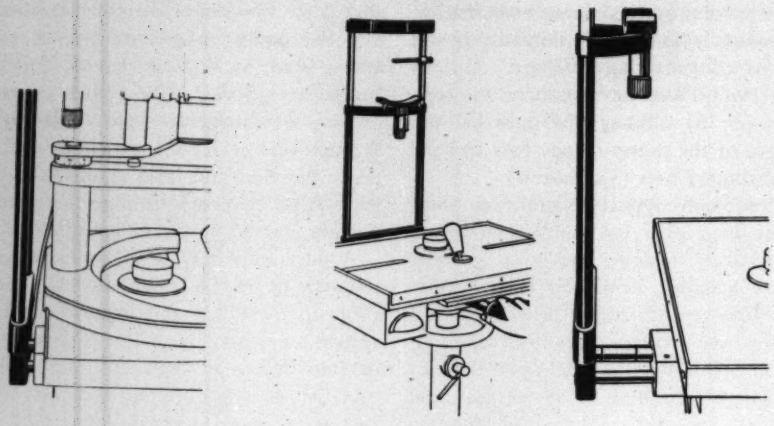

Fig. 1 (Rosen). Technique with Zeiss microscope.

high curvature. The surfaces of this lens should be highly polished. Coating of the lens is suggested. The convex surface of this lens faces the examined eye.

As El Bayadi has mentioned, the microscope is focused on the image of the fundus which is formed 16 mm. behind the supplementary lens. The supplementary lens should be scrupulously clean. It is held between the thumb and index finger so that it can be moved into or away from the examined eye, and so that it can be moved up and down and tilted in any manner in order to avoid the light reflex, as is done with the condensing lens in indirect ophthalmoscopy. I usually place the small finger upon the band of the headrest and find that this gives excellent control and allows the middle or ring finger to hold the upper lid when necessary.

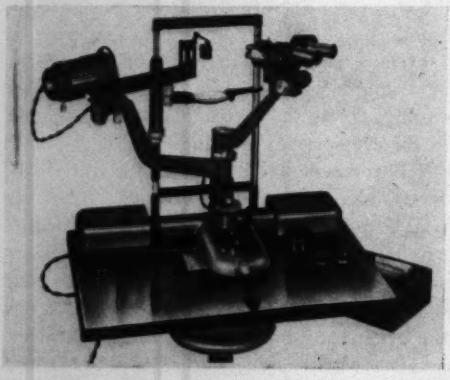

Fig. 2 (Rosen). Technique with Goldmann slitlamp.

The patient should gaze upon the movable fixation light at a level to bring the disc into view. A moderately thin beam of light should be employed, along with the longest beam length. The lowest power of the microscope is used (×6). A field six times the diameter of the disc may be obtained, whereas with the Hruby glass the visible field is about the size of the disc. Once the disc comes into focus the "joy stick" should be locked and the fixation light should be grasped with the unencumbered hand.

Through various angulations of the supplementary lens, including its movement into and away from the examined eye and its movement medially or laterally, while at the same time the fixation light is being moved in all directions, the entire fundus can be examined out to the periphery with ease, especially when the head is rotated in the desired direction or the "locked light" and "microscope" are angled into the desired

direction. The beam of light can be readily intensified when one has focused over the proper area and a rapid increase in magnification power may be readily attempted.

The method is rather simple requiring no preliminary preparation, although a well-dilated pupil is helpful. If the microscope is moved back or the chinrest forward and the clean lens is held as described, the inverted image of the fundus will readily come into view. It requires some practice but in short order a minimal effort will be most rewarding. As skill is acquired, magnification may be readily increased up to well over 100, whereupon vitreous bands adherent to opercula, exudate around vessels, and other phenomena, heretofore visualized only pathologically, will now be seen biomicroscopically.

The magnification attained with the plus lens is much greater than with the Hruby lens. In the use of the Hruby lens it is necessary to examine usually with the highest power available, while with the (+55) lens it is best to start with the lowest power of the microscope.

The magnification can then be increased until the highest power of the biomicroscope is applied. At this point the magnification is very great but if fixation is proper and if the patient holds sufficiently steady, and if highlights are properly avoided, a new world will be unfolded wherein changes will be visualized in the fundus which could not possibly come into view with the usual means available for fundus examination. Under this magnification one can actually see the blood oozing from very tiny vessels.

Much weaker illumination is required for the convex (+55) lens than for the Hruby lens. As a result a narrower beam of light can be used and it is unnecessary to increase the light source through the rheostat.

It is also quite possible to examine the periphery of the fundus with scleral pressure, the scleral depressor being placed directly upon the metal ring surrounding the convex lens.

Case reports

The following case reports illustrate the advantages which have evolved through the use of this technique:

Case 1

This 45-year-old woman had complained of blurred vision in her right eye for several years. She had visited an ophthalmologist about one year after the onset of her original complaint, but no ocular abnormality had been uncovered.

When first examined in 1948, there was present a large cystic mass in the inferior temporal periphery of the right eye. This mass jutted out into the vitreous, was of a pale yellowish color and disclosed many new blood vessels upon its surface. It was present in a zone of exudate and hemorrhage much as is seen in Von Hippel-Lindau's disease, although no enlarged or intercommunicating blood vessels could be seen. In one region an isthmuslike pedicle could be seen running toward the bulging prominence.

In order to visualize this mass which was located in the far periphery, several techniques were employed including indirect ophthalmoscopy, scleral pressure, the Hruby and Allen-Thorpe lens. None of these were satisfactory. It was necessary to dilate the pupil maximally to be able to get any sort of view of this peripheral portion of the fundus. The patient has been kept under observation for several years and it has become increasingly difficult to examine the fundus because of the development of posterior synechias and a posterior complicated cataract. The last few examinations have been conducted with the (+55) lens and the Zeiss slitlamp, the examination being much more readily and much more favorably performed, notwithstanding the fact that the pupil does not dilate very well. The patient herself noted and commented upon the facility of the examination with this new technique.

Case 2

This patient had had a scleral buckling procedure with semi-encircling polyethylene tube. A large buckle could be seen in the lower outer quadrant of the left eye. About 16 months postoperatively this crescentic bulge was readily seen with the binocular and indirect ophthalmoscope. In September, 1958, the patient complained of pain and tearing of his left eye and he became aware of an elevated red area in the upper outer aspect of the left eye. In this region there was present a red cystic area of inflammation moderately elevated and tender to touch. In the lower temporal periphery of the right eye, the buckle was readily visible and under the high power a knoblike projection could be seen bulging well out into the vitreous. It was assumed that this bulge was produced by the sharp end of the polyethylene tube.

CASE 3

In a remarkable case first examined on April 1, 1958, the following observations were recorded: The patient was a 57-year-old man who had developed diabetes in the past two years. With loss of weight (20 lb.) he has been able to control his diabetic condition through dietary measures. His ocular complaints were restricted to occipitofrontal right-sided headache simulating a migrainous attack and associated with nausea and vomiting. Occasional blurring of vision for near was noted.

Careful examination under wide dilatation failed to show any disturbance of iris, lens, vitreous, or retina of diabetic nature. The fundus was carefully combed with direct and indirect ophthalmoscopy and indirect ophthalmoscopy was performed monocularly and binocularly. A mild arterial attenuation was noted in the retinal periphery as though a retinal vessel sheathing were present near the terminus of the blood vessels. There was no exudate, no hemorrhage, and no unusual arteriovenous constriction. The maculas showed no pathology and the disc margins were sharply outlined.

The patient was then examined under the biomicroscope with the (+55) lens. No abnormality was uncovered until I asked the patient to look up and to the right when a large retinal cyst came clearly into view.

I now re-examined the patient with the indirect ophthalmoscope looking carefully in the direction of the large retinal cyst but this could not be seen with this procedure. Red-free light was tried and yielded no positive results. The cyst was quite shallow and did not offer any color contrast with the retinal background.

CASE 4

A woman, aged 58 years, first complained of visual disturbance of the right eye in June, 1958. The initial symptoms were threads in front of the right eye moving to-and-fro, like an insect wing. Later in the evening the patient became aware of small sparks and flashes of light in the temporal periphery. This symptom persisted for several days.

Upon the initial examination, vision was found to be 20/20 in each eye. In the right eye a small linear hemorrhage was present off the disc extending into the vitreous. This seemed to originate from a very tiny vessel on the nasal side of the disc. There was already, even at this first examination, some evidence of absorption. In the nasal periphery at the 3-o'clock position there were some old oval choroidal exudates and nearby was one small red oval area which resembled a hemorrhage. When examined with the (+55) lens this was seen to be a small oval hole and an operculum was seen nearby appearing like a flap seen from the side. In the next 10 days the condition changed considerably and appeared like an ordinary vitreous opacity with no residual signs of hemorrhage. The patient was seen about one month later in consultation by an ophthalmologist experienced in the study of the deep vitreous. The following report was sent to me:

"Thank you for referring this patient. We found vision of 20/20 in each eye. In the left eye there were no pathological changes, in the right eye there was a typical posterior detachment of the vitreous with a small opacity in front of the optic disc. This can be seen very clearly by using the fundus contact lens (mirror). There is no hole in the retina and we therefore think that the hemorrhages which you observed at the onset of the disturbance were due to the detachment of the vitreous. We also examined the periphery of the fundus, but could not find any pathologic changes of the retina. We think that the prognosis in this case is good and that there is no danger of retinal detachment."

Of special note is the fact that there had been no comment concerning the peripheral retinal pathology which was readily visible with the convex lens.

CASE 5

This woman, aged 55 years, had noticed a shadow and smoke rings in front of her right eye of 48 hours' duration. In the dark she was aware of a flickering of light in the midtemporal field of the right eye which she described as a light blinking on and off. Although vision in this eye was recorded as 20/30 this was her better eye and she stated that although she could read the chart it was like looking through a smoke screen.

Examination disclosed no abnormality of the external ocular structures. When examined with the binocular indirect ophthalmoscope a mass of stringy vitreous opacities was present in the prepapillary zone. These were grayish-brown in color and semilunar in shape and oscillated back and forth in front of the disc. The periphery was carefully scanned with the indirect ophthalmoscope and several areas of old round, healed, pigment-girdled chorioretinitic patches were seen especially in the midnasal retinal periphery. Each discrete lesion was about one-third disc diameter. No area of hemorrhage was apparent. Pigment was interspersed within these discrete chorioretinal lesions.

The fundus was then examined with the (+55) lens. With the patient's head turned slightly to the left, and with the patient looking to the extreme left in the midline, the nasal periphery could be readily seen. Two retinal tears were visible among the areas of choroiditis. With an increase in magnification, one oval hole showed an operculum still well attached with a vitreous strand running from the tip of the operculum. The second "hole" appeared between the branches of a "Y" of wishbone type of peripheral vascular degeneration. The lid here was only slightly raised and no definite vitreous band could be seen adherent to this operculum.

SUMMARY

Biomicro-ophthalmoscopy may readily and easily be performed by any oculist who has the Zeiss or Haag-Streit slitlamp and a (+55) convex lens obtainable from the eye

piece of any microscope. The technique is simple; the value is infinite. This technique has not been explored because leaders in the field of biomicroscopy have overlooked this simpler procedure in the pursuit of other promising methods in which they are employing their own lens, mirrors and prisms to the exclusion of all other devices. In the few papers in which the convex (+55) lens has been mentioned, the physiologic optics and the difficulties in the use of the lens have been emphasized, so that only a more or less discouraging attitude has percolated through to the reader.

This technique is a logical continuation or indirect ophthalmoscopy—like going from low to high power. Once an area is placed under suspicion it should be studied further under high power—and there is no easier and no more rapid method than to follow up with the (+55) lens.

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CORNEAL EPITHELIUM AND PENETRATING CORNEAL DEFECTS IN CATS*

With special reference to epithelial downgrowth

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For 50 or 60 years at least, ophthalmologists have evidenced a keen interest in corneal wound healing, and many studies, both clinical and experimental, have been reported in the literature.[1-7] Dunnington[8] has carried out one of the outstanding recent studies on this subject and, in reporting it, has also thoroughly reviewed the literature. The facet of the subject currently commanding special interest is that of invasion of the anterior chamber by corneal or conjunctival epithelium—so-called downgrowth of epithelium.

After reviewing all of these studies, one wonders why this complication is so infrequent. Why does it occur so rarely, even under circumstances that would seem to favor it? Why did it not occur regularly with the limbal cataract incision of 30 years ago, when no sutures were used? Why doesn't it occur regularly now with full-thickness corneal grafts? It seems to occur rarely, if at all, with this operation.[9]

Strikingly like epithelial downgrowth in the anterior chamber is the behavior of epidermoid cysts in finger-tip injuries. Probably no one reaches adult life without having experienced penetrating injuries of the finger-tips. Invasion of the epithelium actually does occur from such injuries but it is rare. Fisher and his colleagues[10] report three epidermoid cysts in the terminal phalanges in three patients, each of which followed trauma 32 years, 12 years and one year previously respectively. In each of these instances an epithelial-lined cyst which destroyed bone

* From the Research Laboratory, St. Luke's Hospital. This study was supported by grants from the Louis W. and Maud Hill Family Foundation of St. Paul, the Edward C. Congdon Memorial Trust, Miss Elisabeth Congdon, and the Women's Service Guild of St. Luke's Hospital.

was found, in two of them definitely connected to the epithelium of the surface. The authors stated that only 33 other similar cases were reported in the literature.

Is there some chemical inhibitor in the aqueous aimed specifically at the corneal and conjunctival epithelium? Kornblueth and Tenebaum[11] report an inhibitory effect of aqueous on the growth of cells in tissue culture. Albrink and his co-workers[12] feel that pure aqueous is just a poor nutrient medium.

McDonald,[13] in an excellent study, demonstrated the importance of fibrin in the early hours of healing and it is his opinion that this may well be the determining restraining factor that prevents epithelial invasion. This would fit in with Estrada's conclusion that if an incision is well sutured there is no danger of epithelial invasion.[14]

Corneal epithelium is somewhat unique in that it migrates. When a traumatic corneal defect is produced, such as an incised groove, the epithelium promptly migrates into it and lines it more or less completely, before cell division and growth of epithelium begin.[15] It also tends to migrate along sutures, frequently penetrating deep into the corneal stroma.[16] Despite this habit of migration, actual invasion remains uncommon.

I have made some counts of epithelial cells floating free in the conjunctival sac during various stages of routine cataract extraction. There seem to be some present at all times and they must inevitably gain access to the anterior chamber. Obviously they do not often grow.

I have carried out two groups of animal experiments dealing with epithelium. The first, and those reported here, deal with the healing of penetrating corneal defects and the behavior of adjacent epithelium. The second, to be reported later, concerns the comparative behavior of respiratory, corneal and conjunctival epithelium when transplanted into the anterior chamber.[17]

The experimental animal used in the first group (this paper) was the cat, unless otherwise specified.

Study I: Parallel incisions (Experiments 1 through 9)

Four or five parallel incisions, spaced in time, were made through the corneas of nine eyes (45 incisions), that is, the incisions were individually made some days apart in such a way that each of the corneas would contain four or five incisions, all at different stages of healing. At the time the animals were killed, the incisions varied in postoperative age from one to 21 days in the shortest experiment, up to five to 50 days in the longest experiment.

These incisions were all made with a Curdy keratome ab externo—the so-called scratch incision—and penetrated into the anterior chamber only for a short distance in the middle. The margins retracted somewhat forming open grooves for epithelial invasion. A deliberate attempt was made to incise with somewhat less than good technique. The knife was usually passed more than once, thus producing irregular incisions.

The epithelium was found to have dipped deeply into all incisions that were less than a week old and presumably this had been the case in all the older incisions also during their first week. In general, the younger the incision, the deeper the pentration of epithelium. This is a familiar phenomenon and is due both to migration and division of cells. One of the first steps in healing was closure of the defect with a coagulum formed from the aqueous, into which fibroblasts migrated. They soon organized the mass into a fibrous structure which, in cross section, was fusiform in shape—the aqueous fibrous "plug." The epithelium did not actually reach the anterior chamber. Conversely, neither did the aqueous coagulum fill the groove in the corneal stroma. The two met at a level deep in the cornea where both ceased to advance. The epithelium dipped in deeply from both margins and

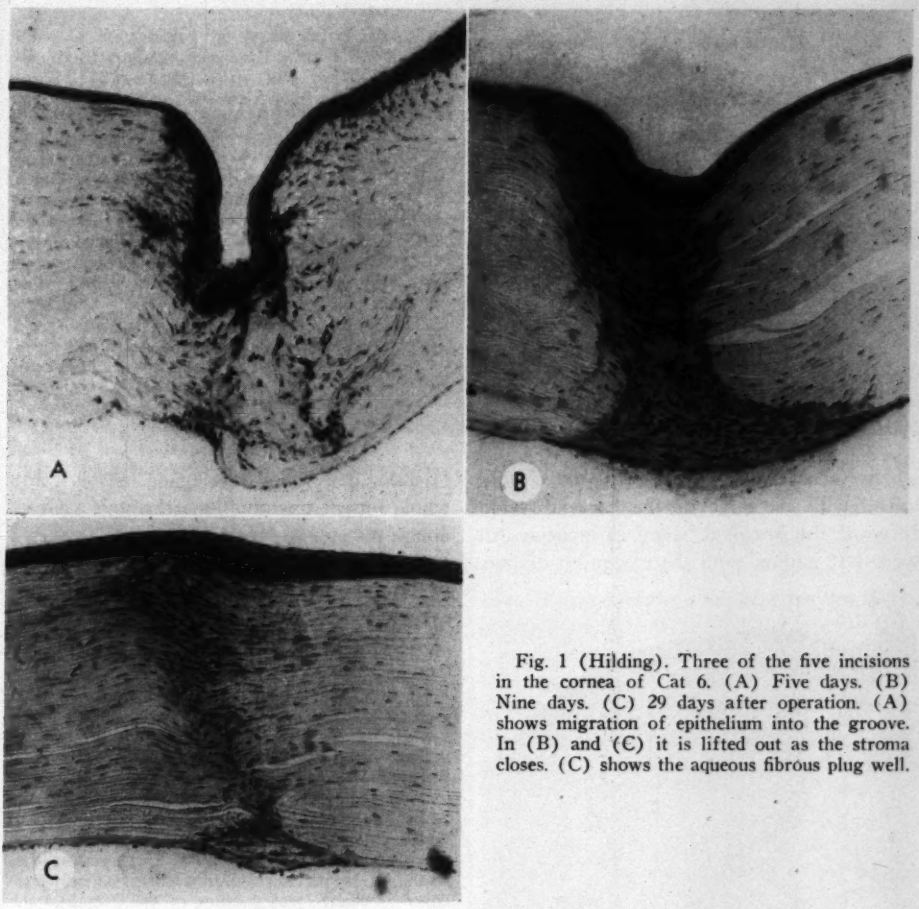

Fig. 1 (Hilding). Three of the five incisions in the cornea of Cat 6. (A) Five days. (B) Nine days. (C) 29 days after operation. (A) shows migration of epithelium into the groove. In (B) and (C) it is lifted out as the stroma closes. (C) shows the aqueous fibrous plug well.

lined the groove—sometimes for half or three-quarters of the thickness of the cornea. The thickness of the epithelium within the groove was two or three times that on the corneal surface (fig. 1-A).

Another of the early steps in the wound closure was the bringing together of the stroma by fibroblasts. In these experiments, this began deep in the cornea and progressed toward the anterior surface, closing the groove progressively as it advanced (fig. 1). The invading epithelium was seemingly simply lifted out without being destroyed. At least no sign of necrosis of the excess epithelial cells was ever found. Neither did they pile up on the surface as a thickened ridge. The epithelial surface was smoothed and thinned to restore and maintain the original curve—presumably what might be called a reverse migration. Often there remained a small depression in the stroma at the site and over this the epithelium retained a compensatory thickening.

Study IIA—simple vertical incisions (Experiments 10 through 20)

Eleven vertical through-and-through incisions were made in 11 eyes by cutting

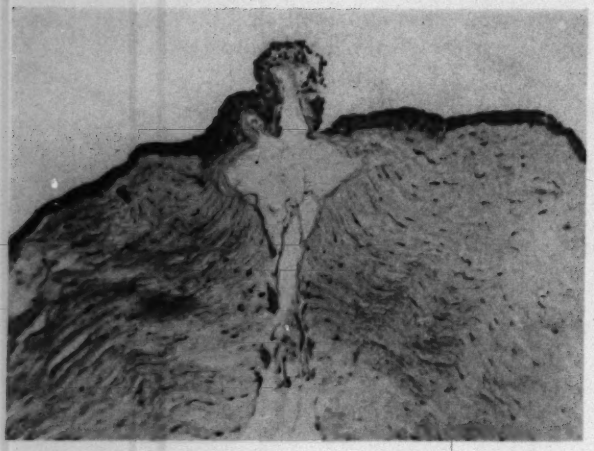

Fig. 2 (Hilding). Vertical corneal incision after 24 hours. Fibrin, presumably deposited by the aqueous, formed a bridge across the gap. The epithelium crossed on this and did not invade. The apparent eversion is artifact.

widely across the cornea with a Graefe knife, with the edge of the knife directed forward, the so-called Saemisch incision. All were left gaping with the exception of one.

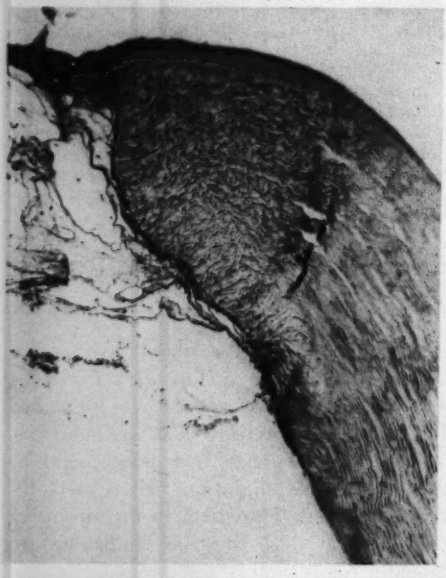

Fig. 3 (Hilding). One side of 48-hour vertical incision showing fibrinous scaffold bridging the gaping incision. The epithelium crossed over this bridge and showed no tendency to invade. Well illustrated also is the marked retraction of the posterior corneal layers commonly found.

Histologic sections were made in seven and whole mount examinations through a Greenough microscope were made on the excised corneas of the remaining four. The time between the operation and the death of the animal varied from 0 to 42 days, with the exception of one that was allowed to live for two years.

Protocols

Experiment 10. One animal died from the anesthetic but the corneal incision was made. The animal was allowed to lie at room temperature for 24 hours, then the eye was enucleated, fixed and sectioned. Microscopic examination revealed no evidence of postmortem migration of corneal epithelium. All layers were cleanly cut. The only evidence of change was swelling of the stroma at the incision to about double thickness. Again, similar to the findings of McDonald.

Experiment 11. One animal was killed 24 hours postoperatively. In this specimen, the cornea gaped widely, the defect was crossed by a lacy fibrin bridge over which the epithelium passed. It was already intact (fig. 2). The epithelium did not invade deep to the fibrin bridge. The space between the stromal ends and between the divided Descemet's and endothelium was filled with lacy fibrin. As yet, there was no cellular infiltration or increase of nuclei in the stroma, although the ends were somewhat swollen. The posterior layers of the stroma were markedly retracted from the line of the incision.

In the next three animals, the postoperative time was 48 hours:

Experiment 12. In the first 48-hour specimen, a fibrin bridge spanned the gaping defect over which the intact epithelium crossed, with no tendency to invade. It was essentially like the 24-hour one (fig. 3) excepting that the swollen corneal stroma contained a small increase in the number of nuclei. The posterior layers of the cornea were strikingly retracted.

Experiment 13. Conditions in the second 48-hour specimen were somewhat different. In this eye also the incision gaped but, instead of a spanning bridge of fibrin at the surface, a plug of fibrin herniated forward from the anterior chamber through the entire thickness of the cornea and protruded beyond the surface. The epithelium ended at the corneal surface on both sides, where it met the fibrin. It neither invaded the incision nor did it cover the protruding fibrin mass. The iris closed the gap at the posterior corneal surface, where it apparently was becoming adherent.

Experiment 14. The incision in the third 48-hour specimen had been closed by a suture. The fibrin plug was limited to the space between the posterior layers of the cornea. The epithelium dipped down into the incision on both sides for half to two thirds of the thickness of the cornea, where there was no fibrin—as was the case in the groove of the ab externo incisions of the first group. It did not reach the anterior chamber. Near the suture on the surface of the cornea, the epithelium was absent or greatly thinned.

Experiment 15. The next animal was permitted to live five days. The incision was found to be closed in the deeper half by a fibrinous seal, leaving a groove about a fourth of the corneal thickness in depth. As in the first group of five parallel incisions, the epithelium that invaded the incision was in the process of being lifted out as the stromal defect was repaired.

Experiments 16, 17, 18, and 19. The next four eyes (32 hours, 14, 28, and 42 days postoperative) were all used in whole mount preparations for studying the scar on the posterior corneal surface. The corneal margins in the 32-hour specimen gaped and the defect was filled in and closed by a fibrinous plug. The epithelium had healed smoothly in the other three eyes.

Experiment 20. The remaining eye, two years postoperative, was so smoothly and completely healed that the incision was not identified.

In this group of eyes in which a vertical through-and-through incision was left gaping, the defect was promptly sealed by a delicate fibrin bridge over which the epithelium had crossed within 24 hours. There was no evidence of invasion. In only one eye did the epithelium dip into the incision to form and line a groove and that was the one that had been sutured. It has been suggested that the incidence of downgrowth may be greater currently because of the use of sutures.

Study IIB: Vertical incisions with sutures
(Experiments 21 through 24)

To test whether the suture might have caused this dipping of epithelium, vertical incisions were made virtually the entire width (12 to 14 mm. in length) of the cornea in both eyes of four more cats. In each instance, the incision in the right eye was closed with three interrupted sutures—6-0 silk in two and 6-0 catgut in two. The incision in the left eye was allowed to gape without any closure.

Results

Suturing or not suturing did not seem to be the determining factor in groove formation. In some of the sutured eyes, the fibrinous seal formed flush with the anterior surface and in some deep in the incision, leaving a groove to be lined by epithelium. The same happened in the unsutured incisions of the controls. In fact, in some incisions, both sutured and control, the level of the seal varied between different parts of the incision.

All eight eyes sealed well and the anterior chamber was fully reformed in all on the first postoperative day.

The four sutured eyes reacted rather severely with inflammation, photophobia, lacrimation, and vascularization of the cornea. When one cat was killed after five days, all three silk sutures were still in place. All nine of the sutures in the remaining three eyes had sloughed out by the 22nd day, with the exception of one catgut suture. This persisted after 35 days. Ulceration with extensive vascularization occurred as the sutures sloughed out. The one eye with the silk suture reacted most violently, but after the last suture had disappeared (between the 19th and 22nd days), it healed completely

and the new vascular system became empty of blood (the vessels could still be seen with the slitlamp).

Study IIC: Irrigation of anterior chamber (Experiments 25 through 28)

The possibility that irrigation with saline solution might have an effect on the fibrinous seal was considered. To test this possibility, both corneas were incised by means of a Graefe knife held vertical to the corneal surface in four more cats. These eight incisions varied between 10 and 12 mm. in length. The anterior chamber of the right eye was irrigated in all four cats in the standard manner: 160 cc. were used in three and 100 cc. in one—admittedly large volumes.

The irrigation had a deleterious effect in all four eyes. At least the right eye did not do as well as the left in any. In one the fibrinous seal was bulging, thin, transparent and gave way on the fourth postoperative day, emptying the anterior chamber. The anterior chamber was still shallow on the fifth postoperative day and presumably did not again fill. This eye subsequently became infected and was lost. The animal was killed on the 14th postoperative day. The right globe measured 27 mm. in diameter and the left 21 mm. There was exudate in the right anterior chamber that herniated through the incision (fig. 4).

In the second cat, the left (control) anterior chamber filled completely in one hour after operation; the right was only half filled after three and one-half hours and the following day the right looked more cloudy and the coagulum bulged more than on the left. By the 10th postoperative day, on the right the coagulum had burst and the anterior chamber was empty. It refilled again but the incarceration of the iris was so extensive it was difficult to judge the degree.

The anterior chamber reformed after a few hours in the other two but more slowly than in the control eye. Both right eyes showed clouding of the cornea near the incision and incarceration of the iris to a strikingly greater degree than in the control eyes during the first few postoperative days. In both animals, the fibrinous seal was less firm than in the left controls. Photophobia and lacrimation were also greater. In both the anterior chamber was more cloudy than in the control eye.

In these four cats irrigation of the right eye had strikingly deleterious effects, as judged by the control (left) eyes. The reaction was much greater, and the seal much weaker. In two it burst, some days after operation.

Study III: Simple oblique or beveled incisions (Experiments 29 through 61)

In this group there were 33 incisions made through the cornea by passing a keratome or Graefe knife obliquely, making a beveled incision. The time between operation and death of the animals varied from one to 156 days, with the exception of a few animals that have been permitted to live, for certain other reasons, up to one and one-half years.

The results can be given quickly. With one exception, all healed smoothly and uneventfully. The incisions were quickly closed with a fibrin seal which became organized progressively with fibroblasts, as in the first experiment. Up to the sixth day, the epithelium dipped into the groove of the incision but was progressively lifted out as the stroma beneath healed. In none was there any tendency for the corneal epithelium to invade the anterior chamber.

A prolapse of the iris occurred in the one exception that failed to heal smoothly. The beveled incision had become an oval defect measuring 8.0 by 11 mm. and the anterior chamber was largely obliterated. Histologically, the prolapse consisted essentially of stretched-out iris tissue covered by corneal epithelium. The iris sac was firmly adherent to the stroma on both sides by means of a

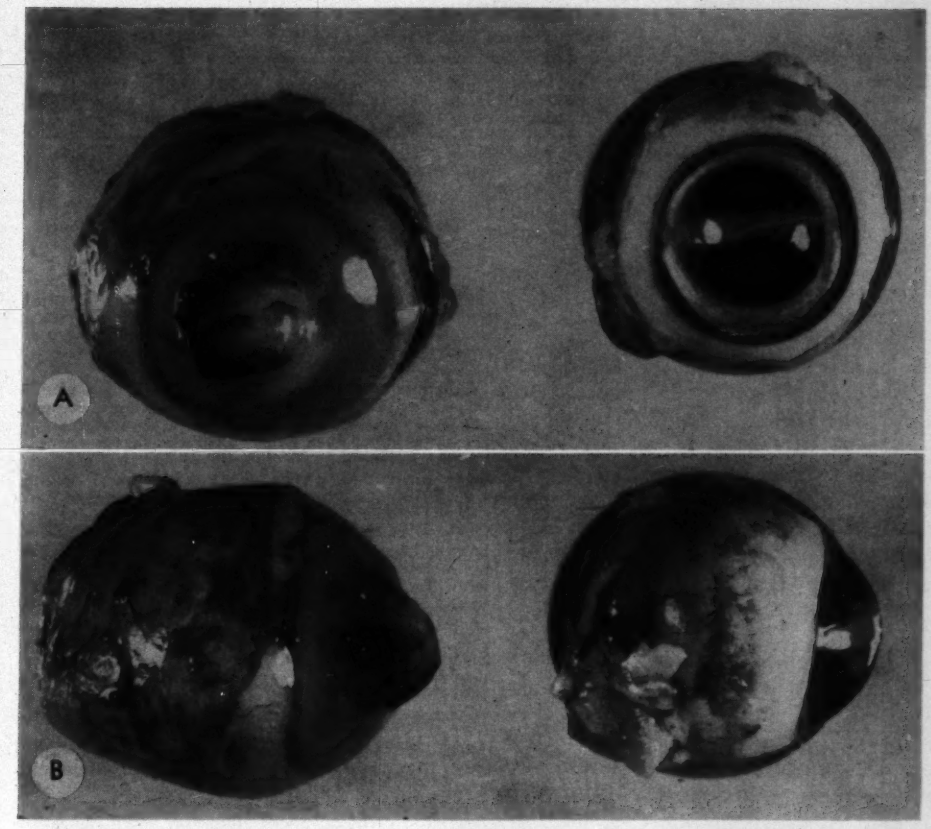

Fig. 4 (Hilding). Eyes from animal killed on the 14th postoperative day. A transverse vertical (to the surface) incision had been made across both corneas. The anterior and posterior chambers on the right were irrigated with 160 cc. saline. The control (left) eye was not irrigated. The anterior chambers refilled immediately after operation but the fibrinous seal in the right was defective and gave way on the fourth postoperative day, draining the anterior chamber. The right cornea was cloudy and bluish compared with the left. (A) Anteroposterior view. (B) Lateral view.

thin layer of new fibrous tissue. The epithelium showed no sign of invading the anterior chamber. This eye will be discussed more fully in another paper.[17]

Study IV: Overriding incisions (Experiments 62 through 75)

Malocclusion of the incision is given as one cause of epithelial downgrowth. To test this possibility in the cat, another experiment was done in which a curved, beveled incision was made in such a way that the central lip could be drawn over the peripheral (posterior) lip and secured in this position by a mattress suture (fig. 5).

This study was done on two animals immediately after death and in 12 others that were permitted to live from six hours to 199 days (table 1).

In the two cats operated on immediately after death, the eyes were enucleated, after seven and 24 hours respectively, and placed in formalin. Histologic sections showed no migration of the epithelium or prolifera-

TABLE 1

STUDY IV: OVERRIDING INCISION

Experiment No.	Post-operative Time	Anterior Chamber	Invasion Anterior Chamber	Microscopic Findings
62	0 hr. (24 hr. post-mortem)	Empty	No	No epithelial migration or proliferation of either epithelium or stroma
63	0 hr. (7 hr. post-mortem)	Empty	No	No epithelial migration or proliferation of either epithelium or stroma
64	6 hr.	Full	No	Epithelium had migrated over cut surface of central (overriding lip). On the underlying lip, epithelium thinned and feathered out to vanishing point where lips were in contact. Posterior stromal layers strongly retracted
65	1 day	Full	No	Epithelium covered exposed cut stromal ends on both sides of incision. Did not extend beyond point of contact of the two lips. Cleft between the adjacent surfaces and the anterior chamber filled with fibrin. At suture, epithelium absent both on anterior surface and cut surfaces. Inflammatory cells on posterior corneal surface
66	2 da.	Full	No	Corneal stroma of central lip markedly swollen and surface epithelium greatly thinned over this area. Epithelium has migrated part way over cut surfaces but does not invade the cleft between the lips. The latter is filled with fibrin across which the epithelium passes. (Widespread fibrin deposit on posterior corneal surface. Thicker near incision and very thin distant from incision.)
67	5 da.	Full	No	Stromal margins had pulled apart. Defect spanned by new fibrous tissue. Intact epithelium passed over on this. (Fibrous layer on posterior corneal surface with iris adhesion at incision.)
68	7 da.	Full	No	Margins had separated somewhat, forming an open groove into which the epithelium had grown and migrated almost to Descemet's. Here it met a new fibrous layer extending across the incision at the posterior corneal surface and advanced no further. Epithelium had followed suture part way through cornea but not as deep as Descemet's (fig. 6)
69	10 da.	Full in situ. (Incision ruptured during enucleation)	No	Suture had cut out and left incision gaping. Gap closed by bridge of fibrous tissue. Epithelium lined resulting groove and passed over the gap on the fibrinous bridge. Epithelium almost within A.C. but was exteriorized by fibrous tissue. Stromal margin swollen. Iris adhesion to fibrous tissue at incision
70	14 da.	Full	No	Wound firmly closed by fibrosis. Operative malposition maintained. (fig. 7). Fibrosis seems to derive partly from aqueous but largely from the stromal cells. Epithelium intact and of normal thickness. Follows irregularities of the malposition but shows no sign of invasion
71	34 da.	Full	No	Similar to previous eye, but ridge lower. Epithelium intact across site of incision. No tendency to invade. Wound closed by fibroblasts from stroma and aqueous coagulum
72	34 da.	Full	No	Epithelium intact across site. No tendency to invade. Lips of wound retracted until curve was about restored. Cleft between lips filled with well vascularized fibrous tissue. Generous infiltration of inflammatory cells. Iris adherent to fibrous "plug" in incision

TABLE I (*Continued*)

Experiment No.	Postoperative Time	Anterior Chamber	Invasion Anterior Chamber	Microscopic Findings
73	40 da.	Full	No	Smoothly healed with dense scar tissue. Some thinning at site. Epithelium smooth and intact
74	80 da.	Full	No	Epithelium intact and smooth over surface. Incision closed by firm scar. Contains some pigment, few blood vessels and inflammatory cells. Iris adhesions to the site
75	199 da.	Full	No	Gray crescentic scar smoothly healed

tion of the epithelium or stroma in either. The anterior chambers were empty.

The other 12 showed stages of progressive repair and healing. Already in the animal killed six hours after operation, the epithelium had migrated over the exposed cut stroma of the central lip—the overriding one. The anterior chamber contained a coagulum and the iris was already adherent. From six hours onward, the coagulum in the anterior chamber and the fibrin between the stromal ends organized progressively until, by the 14th day, a firm scar had formed. In some, the sutures cut out, or at least the margins of the incision retracted, while in others, the overriding incongruity was well maintained until, after some weeks, the scar flattened down to approximately the normal corneal curve. In no instance did the epithelium invade the anterior chamber, although it migrated into any and all grooves that presented themselves. It practically reached the level of Descemet's membrane in the seven- and 10-day eyes, but was excluded in both by a newly formed fibrous layer. In all of the eyes, the wound was closed by fibrin and fibrosis, thus excluding the epithelium. The fibrous tissue that closed the wound seemed in part to come from organization of the fibrin mass that formed in the aqueous and partly from fibroblasts produced from the stromal cells. In all, there developed an inflammatory response and an adhesion of the iris formed more or less regularly.

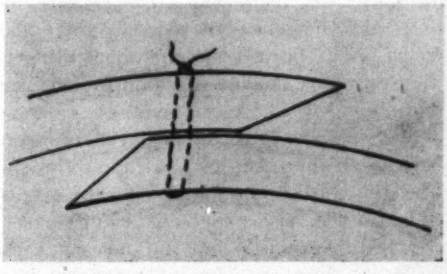

Fig. 5 (Hilding). Diagram of the method of placing the suture through the margins of the overriding incision.

Study V: Through-and-through sutures

(Experiments 76 through 84)

Corneal epithelium has been found experimentally and clinically to migrate along the track of a silk suture passed into or through the cornea.[18,19] It has been suggested that this might result in invasion of the anterior chamber by epithelium if the suture penetrated.[20,21] To test further this possibility, a number of experiments were done in guinea pig and cat eyes.

Silk sutures (6-0) were passed through the cornea, into and across the anterior chamber and out again in each instance. Instead of tying these sutures, they were cut off flush with the cornea at both puncture and counter puncture. Three such sutures were placed in each of two guinea pig eyes and one in each of seven cat eyes.

Three sutures were placed serially in both eyes of one guinea pig so that, when the animal was killed, the time intervals between placement of the sutures and death were

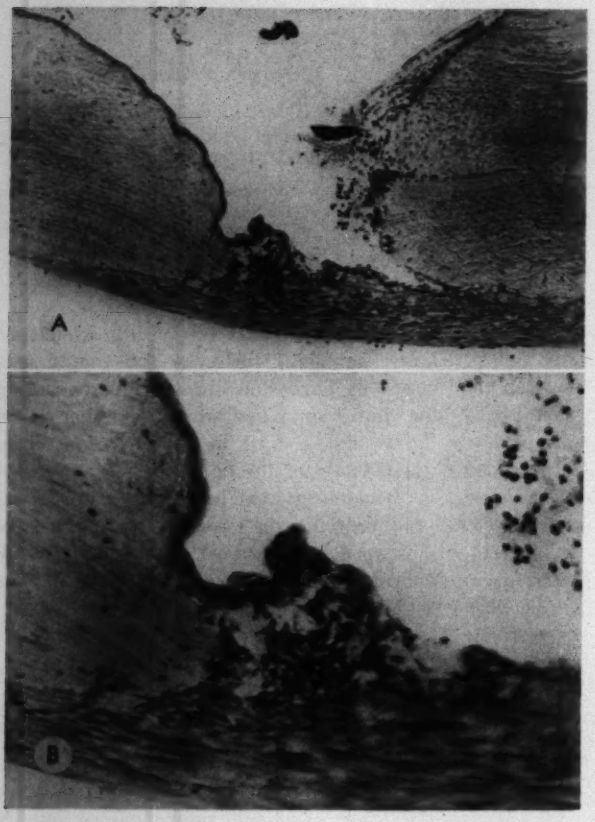

Fig. 6 (Hilding). (A) Seven-day eye. The margins have pulled apart. The underriding one is covered with epithelium that advanced almost to the level of Descemet's, where it met new fibrosis. The cut stroma of the overriding one is covered with exudate. (B) High-power view of the termination of the epithelium.

63, 15 and two days. No sign of epithelial invasion was evident in either eye at the time of death. All three sutures could be readily identified in serial sections through the left eye.

That portion of the oldest suture (63 days) contained within the anterior chamber was covered by a conduit of connective tissue and this, in turn, was covered by endothelium. Consequently the suture was exteriorized as far as the anterior chamber was concerned. The epithelium followed down the track of the suture about two thirds of the thickness of the cornea. The suture was surrounded by an infiltration of inflammatory cells, mostly monocytes and giant cells.

At the two-day suture, the epithelium already followed the track practically to Descemet's membrane. It was very thin and flat, being only a single layer of cells. The stroma had not yet reacted by multiplication of nuclei but there was a considerable infiltration of neutrophils. Already there was a deposit of fibrin upon and about the portion of suture contained within the anterior chamber.

The findings about the 15-day suture were similar to the other two as far as the epithelial growth was concerned. In the case of this suture also, the epithelium almost reached Descemet's but did not enter the anterior chamber. The inflammatory reaction was intermediate between the two.

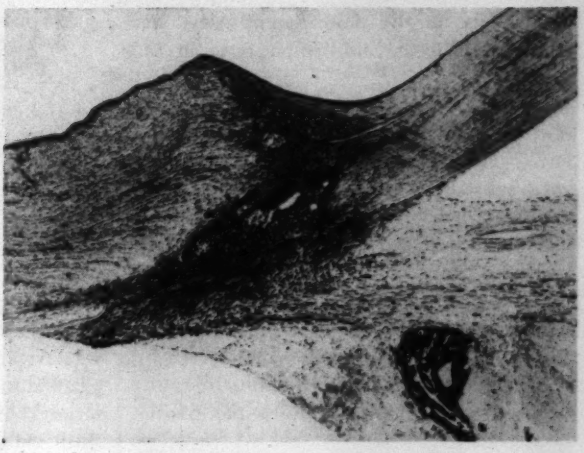

Fig. 7 (Hilding). Fourteen-day eye with the overriding position maintained. The epithelium accommodates itself to the incongruity and rides smoothly over the site. The thicker lip is the central and overriding one.

Similar single though-and-through 6-0 silk sutures were placed through the cornea and across the anterior chamber in one eye in each of the seven cats. The cats were killed after varying periods of time had elapsed (7, 14, 34, 125, 199 and 551 days).

The histologic findings indicated a defensive process similar to that in the guinea pig's eye. Epithelium followed the suture into the cornea for varying distances. It was deepest in the seven-day eye, where it practically reached Descemet's. In no instance did it reach the anterior chamber. In each eye, a fibrous conduit had been built about the suture and connected with both the puncture and counter puncture by water-tight seals (fig. 8). Thus, the suture was exteriorized and the epithelium excluded. This conduit was already complete in the youngest—the seven-day eye. Four eyes had accomplished the seemingly impossible task of ridding themselves of the suture entirely. They did so by extruding the suture from the conduit that had formed about it. In the 34-day eye, it was already gone after five days. In the others, it was gone after 12, 32 and 34 days respectively. Some fibers still remained in the 125-day eyes. After the suture had been extruded, the gray zone of infiltration about the needle punctures grew progressively less marked until it eventually practically disappeared. The entire conduit disappeared in the 34-day eye but could still be seen faintly in the 139-day eye.

Histologically, the inflammatory reaction consisted of an infiltration of leukocytes and

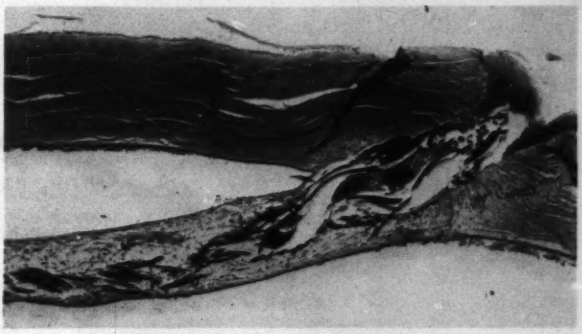

Fig. 8 (Hilding). A through-and-through 6-0 silk suture passing through the cornea and across the anterior chamber seven days after placement. A fibrous conduit had been built about it, thus exteriorizing it from the anterior chamber. The connection of the conduit at the corneal puncture appeared to be water-tight and cell-tight. The corneal epithelium followed the suture track about to the level of Descemet's.

neutrophils, in the more recent ones, and mononuclear cells and lymphocytes in the older ones.

The chief findings in this suture study can be given briefly: The epithelium followed down the track of the suture, for a very substantial part of the corneal thickness, very soon after it was placed—in some instances, practically to Descemet's membrane. A conduit composed of fibrin or fibrous connective tissue, covered by endothelium, formed about that portion of the suture contained within the anterior chamber, thus exteriorizing it. In some, the suture was extruded following which the conduit disappeared.

Study VI: Simple trephination (Experiments 85 through 92)

Thinking to supply a means of entrance for the corneal epithelium into the anterior chamber through some type of defect that could not be drawn together or closed by apposition, a two-mm. trephine opening was made in one cornea of each of eight cats and the button removed. In one eye, a second one was made nine days after the first. The results are given in Table 2.

In these eight eyes in which the cornea was trephined, the epithelium did not migrate into the opening nor invade the anterior chamber. A delicate fibrinous bridge, flush with the anterior corneal surface, was

TABLE 2

Study VI: Simple trephine openings

Experiment No.	Postoperative Time	Anterior Chamber	Migration of Epithelium over Stromal Margins	Invasion Anterior Chamber	Histologic Findings
85	0 (7 hr. postmortem)	Empty	No	No	All layers cleanly cut. No migration of epithelium. Stroma slightly swollen
86	3 da.	Full	No	No	Trephine opening spanned by lacy fibrinous scaffold. Thin at center but intact. Epithelium crossed the fibrin bridge and was intact. Thick at margins of opening. Thin over bridge. Stromal ends swollen two times and cells proliferating (fig. 9)
87	6 da.	Full	No	No	Opening closed by more substantial fibrin bridge into which fibroblasts migrated. Plug half of corneal thickness. Intact epithelium crossed site three times normal thickness. Site depressed
88	12 da.	Full	No	No	Solidly closed by fibrous tissue. Epithelium extended across and appeared normal
89	20 da.	Full	No	No	Defect closed by rather dense fibrous tissue half the thickness of the cornea. Epithelium crossed over this and appeared about normal. Descemet's not cut on one side but the new fibrous tissue was in contact with A.C.
90	24 da.	Full	No	No	Defect closed by depressed scar covered with epithelium two to three times normal thickness. Descemet's not cut on one side
91	87 da.	Full	No	No	Findings with corneal microscope—cleanly and smoothly healed. No sign of epithelial invasion. Scar wider at posterior surface where cornea had been curetted. Section—no epithelium in A.C.
92	147 da.	Full	No	No	Findings with corneal microscope—site smoothly healed without any indication of invasion. Histologic section—no epithelium in A.C.

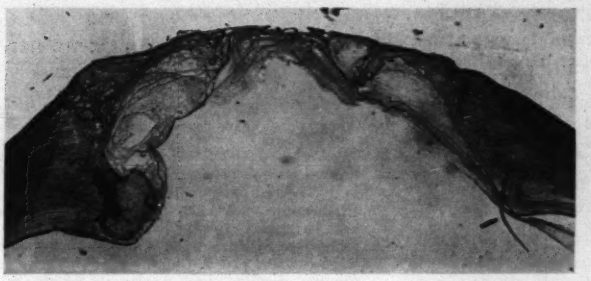

Fig. 9 (Hilding). A three-day corneal trephine opening. The defect is spanned by a lacy fibrin bridge over which the intact corneal epithelium passed. There was no tendency for the epithelium to migrate over the margins of the opening—much less to invade the anterior chamber. The stromal margins were swollen and the posterior layers retracted.

formed in the trephine opening and the epithelium crossed on this even before organization of the fibrin by fibroblasts had begun. It did not dip into the trephine opening at all.

Study VII: Trephine opening with iris wick (Experiments 93 through 100)

Since the trephine openings in the cornea were promptly sealed by fibrin, which seemingly prevented migration of epithelium into the opening, it was thought that possibly this could be prevented by shaping an iris wick and permitting it to protrude through the trephine opening. It was thought that this might also serve as a pathway for epithelial migration. It is a common belief that postoperative downgrowth of epithelium in man is caused or favored by the presence of intraocular structures—lens capsule, iris, or vitreous—between the lips of the incision.

Consequently, a two-mm. trephine opening was made through one cornea in each of eight more cats. The iris was drawn out through the opening in the form of a little wick, three sides of which were incised with scissors in such a way as to make a tongue, based at the iris root and sufficiently long so that it could extend out through the trephine opening without tension. The cats were killed serially after an elapsed postoperative time ranging from six hours to 80 days (table 3).

In this study also, the corneal epithelium failed to dip over the cut margin of the trephine opening—even with a wick of iris protruding. On the other hand, it looked thin and flattened in the vicinity of the protruding iris. The iris wick quickly swelled and became surrounded and covered by fibrin and other elements of inflammatory exudate. These formed a seal about the intracorneal portion, successfully plugging the trephine opening and thus permitting the anterior chamber to refill promptly. As the exudate organized, the protruding mass of iris became flattened progressively. In those that were 10 days or older, intact epithelium covered the iris dome. In those five days or less old, the protruding iris was devoid of epithelium.

Discussion

In none of the foregoing studies was it possible to induce the corneal epithelium to invade the anterior chamber. In the parallel groove incisions, at different stages of healing, the epithelium migrated deeply only to meet fibrin sealing off the anterior chamber. As healing of the stroma progressed, the epithelium was lifted out again to the surface. Widely gaping vertical or oblique incisions were bridged by fibrin scaffolding across which the epithelium migrated. In both types, the anterior and posterior corneal layers tended to retract more or less strongly (especially the latter), but the defect was invariably bridged and the epithelium excluded from the anterior chamber.

The details in the overriding incisions were different because of the malposition of the margins and, in at least one animal, the epithelium reached the level of Descemet's

TABLE 3

STUDY VII: TREPHINATION WITH IRIS WICK

Experiment No.	Postoperative Time	Anterior Chamber	Migration of Epithelium into the Opening	Invasion Anterior Chamber	Epithelium Covers Iris Wick	Histologic Findings
93	6 hr.	Full	No	No	No	Iris wick incarcerated in trephine opening and covered with inflammatory exudate. Epithelium ended sharply at edge of opening. It neither dipped into opening nor extended over the iris wick. Epithelium thinned where wick lay against corneal surface. Stroma swollen and posterior layers retracted moderately
94	1 da.	Full	No	No	No	Iris wick protruded and lay against anterior corneal surface. Here the epithelium was thinned. Epithelium ended sharply at trephine edge where it made contact with the iris wick. Proliferation of stromal cells beginning. Iris structure in close contact with cut stroma
95	2 da.	Full	No	No	No	Iris wick plugged trephine opening and protruding portion lay against cornea thickly covered with fibrin, inflammatory cells and hemorrhage. Epithelium greatly thinned or absent where wick lay in contact. Epithelium ends at margin of opening. Early proliferation of stromal cells. Stromal margins fanned out—swollen
96	5 da.	Full	No	No	No	Iris hernia 7 mm. above cornea. End measures 3×7 mm. Thickly covered with inflammatory exudate. Layer of new fibrous tissue between iris wick and adjacent cut stroma. Surface epithelium thinned on central side. Stroma twice normal thickness and full of proliferating stromal cells and inflammatory cells
97	10 da.	Full	No	No	Yes	Iris hernia flattened to 1 mm. Covered with intact epithelium and incorporated in heavy fibrous tissue coming from corneal stroma
98	21 da.	Full	No	No	Yes	Site presented flattened facet with iris adhesion. Corneal stroma replaced by layer of dense scar tissue
99	40 da.	Full	No	No	Yes	3 mm. dome at site elevated 1 mm. Iris incarcerated in dense scar. Intact epithelium over the dome with layer of new connective tissue between epithelium and iris hernia
100	80 da.	Full	No	No	Yes	Site marked by flattened facet 3×4 mm. Iris incarceration. Covered on anterior surface by dense fibrous layer and this by intact epithelium. Constriction about iris hernia at posterior corneal surface. Intracorneal portion mushroom shaped

membrane. Nonetheless, fibrin bridged the defect and filled in the angle of the incongruity and no epithelium entered the anterior chamber. It was of interest to note that where the overlying central lip covered the epithelium of the lower lip, the epithelium thinned out greatly or tended to disappear entirely.

One would suppose that a corneal trephine opening would surely admit the epithelium to the anterior chamber, since the margins cannot be approximated, or that it would at least keep the anterior chamber empty. Neither happened. Again, a scaffold of fibrin bridged and sealed the defect at the level of the anterior corneal surface and the epithelium crossed over on the bridge quickly. The anterior chamber was completely reformed the next day. The rest of the process was simply organization of the fibrin plug and rebuilding of the stroma through fibrosis.

The formation of a protruding iris wick, along which the epithelium might migrate, also failed to encourage invasion and also failed to keep the anterior chamber empty. The wick seemed only to aid the newly formed fibrin to plug the hole. It swelled, became covered first with exudate, then with fibrous tissue and epithelium. Where the iris wick overlay the adjoining corneal epithelium, the latter became thinner, sometimes becoming only a single layer or, in some, it even disappeared entirely.

The series of events following the placing of a through-and-through silk suture was the most amazing of all. The eye performed the seemingly impossible feat of disposing of a nonabsorbable suture which could neither be cut out nor pushed out. Corneal epithelium generally followed along the suture deep into the cornea. In none was it seen to pass Descemet's. Even had it done so, it would still have been outside the anterior chamber, because a fibrous conduit that exteriorized it was quickly built about the suture. In some eyes, the suture later slid out of this conduit and was disposed of. In some, the conduit subsequently disappeared and all that finally remained were microscopic scars at the points of puncture and counter-puncture.

The fibrin closure of the incisions was not always at the same level. In some it was flush with the corneal surface and in some it formed deep in the incision, leaving a groove to be lined by the migrating epithelium. Tests were made to see if the presence of sutures determined the level at which the fibrin plug formed. These experiments indicated that the sutures were not the determining factor.

The only defective fibrin seals that were produced occurred in those eyes which were irrigated. In these, closure was delayed, formation of the anterior chamber was delayed; as compared with the fellow eye, there was much more severe reaction, and, in two, the fibrin seal ruptured, emptying the anterior chamber some days after operation.

The "early components" of healing, to which McDonald called attention, seem to be more highly developed in the cat than in man. I think that it is virtually impossible to cause the corneal epithelium to invade the anterior chamber in a cat unless something (such as heparin) be administered to prevent the formation of fibrin. In these experiments, there seemed to be no evidence of, or need to postulate, a chemical substance in the aqueous to prevent epithelial growth. It never reached the anterior chamber, so that question remains unanswered.

If these findings in the cat could be applied directly to man, one would conclude that there is no danger of epithelial downgrowth from corneal epithelium through corneal defects such as incisions for cataract removal, no matter how performed. The cat is far removed from man genetically and apparently the "early components of healing" are more effective than in man.

These findings, as far as they can be applied to man, lend support to the principle that if the wound is well closed and the "early components" be given full play, downgrowth of epithelium is not likely to occur. The findings of McDonald are confirmed.

The role of the conjunctiva is another problem that must be considered separately.

Conclusion

The corneal epithelium in the cat cannot readily be made to invade the anterior cham-

ber. In fact, with the measures used in these studies, it seemed impossible. In each experiment, it was blocked by a fibrin deposit that bridged the corneal defect. This fibrinous seal effectively closed and maintained closure in all defects except in those eyes that were irrigated at the time of operation. Irrigation had a definitely deleterious effect upon the formation of fibrin and closure of the incision. The closure was weaker and the reaction very much greater.

An article on the comparative behavior of corneal, conjunctival and respiratory epithelium transplanted into the anterior chamber will follow.[17]

St. Luke's Hospital.

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ENHANCING EFFECT OF CORTICOTROPHIN*

Upon exophthalmos produced by thyrotrophic hormone

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Some fishes respond with an increase in the protrusion of the ocular globes as a result of different hormonal stimuli. Albert[2] produced exophthalmos in Fundulus heteroclitus by means of intracelomic injections of anterior pituitary extracts. Dobyns and Steelman[5] showed the possibility of obtaining the same effect by injecting preparations of pituitary gland without thyrotrophic action. Pickford[9] on the contrary, observed that there is a narrow relation between exophthalmos-producing and thyroid-stimulating effects of thyrotrophic preparations. The same phenomenon was observed in the treatment with tri-iodothyronine and dessicated thyroid.[7] On the other hand, Matty and coworkers[8] succeeded in producing exophthalmos by injecting androgens in two species of teleost fishes (Sparisoma squalidum and Scarus croicensis) and by the injection of *L*-thyroxine and tri-iodothyronine in these two species and also in the Bathystoma aurolineatum.

In Spain it is impossible to obtain Fundulus heteroclitus or any of the species of fishes with which the above-mentioned authors have worked. In a series of previous tests we investigated the possible exophthalmic action of the anterior pituitary extracts in the following fishes: Barbus fluviatilis, Ciprinus carpio, Leuciscus erythrophtalmus, Fundulus hispanicus, Carassius auratus, Perca fluviatillis, Tinca tinca, Gobitis fossilis, Gobius fiuviatilis and Ameiurus nebulosus. All these, except the last, under diverse experimental conditions can develop exophthalmos following injection of thyrotrophin. Since we were able to obtain Carassius auratus (var. japonicus) in unlimited quantities we used this species for almost all our investigations. Among the many types of gold fish, the Carassius auratus var. japonicus, subvar. bicaudatus show a larger sensitivity and uniformity of response. This subvariety has a more globulous body and a flatter head. From this fish procedes by genetic selection the Carassius macrophthalmos in which enormous protrusion of the ocular globes is sometimes a constitutionally inherited characteristic (fig. 1).

We have presented numerous clinical and experimental arguments in previous papers[4,5] confirming that the exophthalmos characteristic of Graves' disease and other related forms of ophthalmopathy (edematous exophthalmos, malignant exaphthalmos, infiltrative ophthalmopathy, exophthalmic ophthalmoplegia, and so forth) are secondary to a hyperfunction of anterior pituitary. According to Aterman[3] the adrenal cortex also participates in the pathogenesis of these conditions. Experimenting with golden hamsters we have confirmed that the presence of the adrenal glands is absolutely indispensable to the provoking of exophthalmos by injections of thyrotrophin and that previous treatment with corticotrophin or adrenal steroids reinforces the exophthalmic action of the thyrotrophic hormone.[5]

The series of experiments that follow were planned to study the effect of corticotrophin on the exophthalmos produced in Carassius auratus (var. japonicus, subvar. bicaudatus) by intracelomic injections of thyrotrophin and its influence on the eye protrusion obtained by injection of thyrotrophin directly into the retrobulbar tissues.

Experimental methods

Part I

Groups of 10 Carassius, about two years of age and uniform in size (9-10 cm. long)

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Fig. 1 (Barraquer and Cañadell). Telescopic-eyed gold fish (Carassius macrophthalmus) with genetic constitutional exophthalmos and a common gold fish (Carassius auratus).

were injected intracelomically at intervals of eight hours with thyrotrophic extract, the doses varying from 0.25 to 25 Heyl-Laqueur units. Other similar groups were injected with corticotrophin, chorionic gonadotrophin, growth hormone, human serum, and normal saline solution. The treatment was followed for a space of five consecutive days, examining the aspect of the fishes and measuring the protrusion of ocular globes with a caliper with a Vernier scale before giving the injections.

PART II

Other groups of gold fish were treated with the same doses of thyrotrophin adding to each injection two international units of corticotrophin. Control groups were similarly treated with corticotrophin and chorionic gonadotrophin, growth hormone extract, human serum and normal saline solution.

PART III

In this experiment the exophthalmic effects of the retrobulbar injections of thyrotrophin were studied. The material was injected only once across the conjunctival sac of both eyes with an insulin syringe and a needle of small caliber. The dose was 0.05 cc. (5.0 u. Heyl-Laqueur). Control fishes were injected with the same volume of corticotrophin, corionic gonadotrophin, growth hormone and normal saline solution. The resulting ocular protrusion was determined immediately after the injections and at regular intervals of eight hours.

PART IV

The fishes were previously treated intracelomically with a dose of 5.0 u. of corticotrophin-zinc and afterward exophthalmos was brought about in the same manner as in the fishes of the previous experiment.

RESULTS

The intracelomic injections of thyrotrophin at doses of 10 u. Heyl-Laqueur (total quantity injected 150 u.) produced a variable exophthalmic effect. Only in two fishes of 10 injected was a small augmentation of the ocular protrusion and the intercorneal distance increased 1.5 mm. and 1.8 mm., respectively. Administering 25 u. by injection (total dose 375 u.) exophthalmos was observed in seven fishes, four of which were perfectly evident on simple inspection and without the measuring of intercorneal distance being necessary (fig. 2). The increase in the intercorneal distance was 3.8 mm. ($\pm$1.15 mm.). Larger doses of 25 u. were

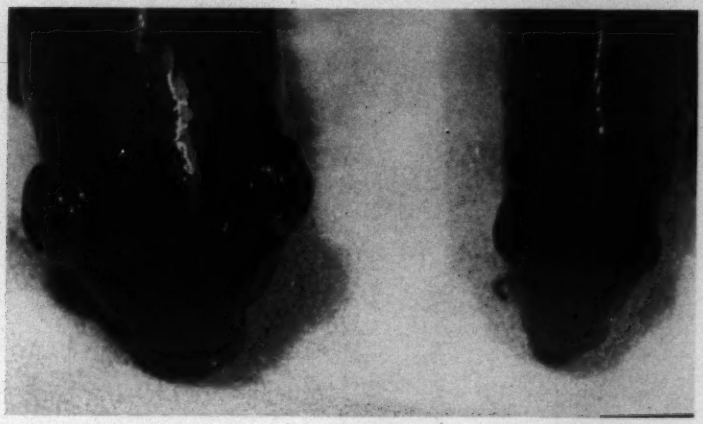

Fig. 2 (Barraquer and Cañadell). Exophthalmos produced with systemic treatment with thyrotrophin. (At right) control fish.

ill tolerated and smaller doses of 10 u. had no effect. Exophthalmos was not observed in any of the fishes of the control groups injected with corticotrophin, growth hormone, chorionic gonadotrophin, human serum, or normal saline solution.

In the animals with positive results, the exophthalmos began to appear on the third day of the experiment, became more evident in the two following days, and disappeared completely at the end of two or three days after ceasing to inject thyrotrophin.

We observed that the injection of corticotrophin reinforced the exophthalmic effect of the thyrotrophin without increasing the intensity of the maximum result. Injections of 10 u. of thyrotrophin, with a very small exophthalmic effect (see above), produced exophthalmos in six fishes with increase of the intercorneal distance of 2.9 mm. ($\pm$0.6 mm.) when it was injected with corticotrophin. Injections of 25 u. of thyrotrophin caused exophthalmos in nine fishes. The evolution of exophthalmos followed the same course as in the animals injected only with thyrotrophin without complementary treatment with corticotrophin. Control groups injected with thyrotrophin and chorionic gonadotrophin, growth hormone, human serum or normal saline solution developed exophthalmos of the same kind as that of the fishes treated only with thyrotrophic hormone. These products are devoid of the enhancing effect of corticotrophin.

The retrobulbar injections of a small quantity of normal saline produced a transitory increase of the ocular protrusion, could obtain an augmentation in the intercorneal distance of five mm. or more with perfect tolerance by the fishes. The exophthalmos persisted for a space of some four hours, then diminished progressively and disappeared in the course of the following eight hours. Injection of gonadotrophic hormone, corticotrophin, growth hormone or human serum produced the same phenomenon but, possibly because of the proteic composition of these fluids, the exophthalmos persisted for about 24 hours. On the contrary the exophthalmos produced by injection of thyrotrophin is always more persistent and after 24 hours the increase of the intercorneal distance is still 80 percent ($\pm$ six percent) of the initial value and after 48 hours it is 12 percent ($\pm$ seven percent).

In the fishes treated previously with corticotrophin-zinc one observes that the increase of the ocular protrusion produced by thyrotrophin is much more persistent. After 24 hours the increase in the intercorneal dis-

Fig. 3 (Barraquer and Cañadell). Ocular protrusion provoked by retrobulbar injections of thyrotrophin 24 hours before. First fish on the left was previously treated with long-acting corticotrophin; the fish in the middle did not receive corticotrophin; on the right is the control fish in which exophthalmos was produced by injecting human serum. Note the persistence of ocular protrusion of both fishes treated with thyrotrophic hormone and the greater degree of exophthalmos in the fish that received corticotrophin.

tance still equals 82 percent (± three percent) of the initial value and after 48 hours it is 58 percent (± five percent) and after 72 hours it is 22 percent (± 10.5 percent) (fig. 3).

Discussion

The difficulties of producing exophthalmos in some fishes by the injection of anterior pituitary extracts or near pure thyrotrophic preparations suggest the existence of an exophthalmic factor distinct from the thyrotrophic hormone.[1,6,7] Nevertheless even though it is a trifle risky to apply the results of our experiments directly as a basic explanation of the pathogenesis of the exophthalmos of Graves' disease, they confirm our hypothesis[5] that this phenomenon probably develops by the effect of a combination of several endocrine factors. The action of thyrotrophic hormone is the essential desencadenating factor; the corticotrophin and the activity of the adrenal cortex have a potentializing effect possibly increasing the sensibility of the retrobulbar tissues to the exophthalmogenous action of thyrotrophin. The experiences of Langford[8] and of Matty, *et al.*[9] in that they showed the possibility of producing exophthalmos in fishes by thyroid hormones seem to oppose the thyrotrophic hypothesis, since the administration of thyroxin produces an inhibiting effect on the pituitary secretion of thyrotrophin. However, in previous experiments[5] we observed that large doses of thyroid hormone increase the thyrotrophic exophthalmos, while weak doses of the same are capable of reducing it.

These results—apparently paradoxal—could be explained by the toxic action of the thyroxin, which is capable of stimulating the anterior pituitary-adrenal system,[10] increases the corticotrophic and corticoid secretion and indirectly creates experimental conditions analogous to those obtained by injecting thyrotrophin and corticotrophin.

Summary

Gold fish (Carassius auratus, var. japonicus, subvar. bicaudatus) respond to the administration of thyrotrophic hormone with exophthalmos. Eye protrusion increases with simultaneous injections of corticotrophin. Retrobulbar injections of normal saline, human serum or pituitary hormones produce a transient exophthalmos, which is very much more persistent when thyrotrophin is injected. Previous treatment of fishes with long-acting corticotrophin prolongs the duration of the exophthalmos caused by the

retrobulbar injections of thyrotrophin; this effect is not observed when other fluids are injected.

Instituto Barraquer.

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NEW TEST CHARTS FOR THE MEASUREMENT OF VISUAL ACUITY AT FAR AND NEAR DISTANCES*

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Measurements of far and near acuity are needed not only to establish eligibility for blind pensions, tax reductions, and other special benefits, or for admission to sight saving and other special schools, but also to determine fitness for many different job assignments in industry and in the military services. The ophthalmologist uses measurements of acuity primarily as an aid in determining the error of refraction and in diagnosing and following the progress of ocular disease. Because of certain inadequacies in presently available test charts, the Committee on Optics and Visual Physiology of the A.M.A. appointed a subcommittee to draw up specifications for new charts for the testing of far and near visual acuities. This paper describes the special features of charts developed at the Wilmer Institute and approved by this subcommittee.†

CHOICE OF OPTOTYPES

The optotypes recommended for testing literate subjects are a specially selected[1,2] set of 10 capital letters, namely Z N H R V K D C O S. Because these include vertical, horizontal, oblique and curved contours they are well suited for use in subjective tests for determination of the error of refraction. The design of the letters follows the Snellen principle in that the over-all height and width are five times the width of the strokes. The letters are of the familiar Gothic form and

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital. The development of these charts was supported by Grant B-810 from the National Institute of Neurological Diseases and Blindness, Public Health Service, Bethesda, Maryland.

† The members of this subcommittee are Gerald Fonda, M.D., Chairman, James E. Lebensohn, M.D., Kenneth Ogle, Ph.D. and Louise L. Sloan, Ph.D.

therefore differ from the Snellen capital letters in that the serifs are omitted.

Experimental evidence[2] suggests that these letters are about as nearly equal in legibility as can be obtained when simple capital letters of familiar form are used. Table 1 presents data on the relative legibilities of these 10 letters based on visual acuity measurements of 234 eyes, having various types and degrees of uncorrected error of refraction. It must be emphasized that, for the individual patient, the differences in legibility between the different letters may be greater than those shown in the table. Since, however, the test charts employ the same 10 letters in each of the different sizes, the legibility of the group as a whole is determined only by letter size. For the larger sizes, where it is not practical to use as many as 10 letters, a selection has been made which has the same average legibility as that of the complete set.

An important feature of this particular group of 10 letters is that their average legibility has been shown[2] to be equal to the difficulty in visual resolution of the Landolt ring with breaks at horizontal and vertical locations. This equality holds at all acuity levels ranging from 20/200 to better than 20/20, and holds not only for eyes having spherical errors of refraction but also for those having astigmatic error at horizontal, vertical or oblique axes. If this group of 10 letters is adopted as standard for the testing of literate subjects the Landolt ring is therefore the logical choice of optotype for the illiterate subject.

TABLE 1

RELATIVE DIFFICULTY OF LETTERS: 234 EYES

Letter	Percent of Correct Responses at the Threshold	Deviation from Average Percent Correct
Z	94.0	+12.0
N	91.6	+ 9.6
H	89.3	+ 7.3
R	86.3	+ 4.3
V	84.6	+ 2.3
K	82.1	+ 0.1
D	79.5	− 0.5
C	71.4	−10.6
O	71.0	−11.0
S	70.6	−11.4
AVERAGE	82.0	

The Landolt ring was adopted in 1909 by the XI International Ophthalmological Congress as the standard test object.[3] Committees of the American Medical Association in 1916[4] and in 1930[5] recommended for routine testing the use of letters whose relative difficulty of discrimination had previously been determined by comparison with the Landolt ring. The fact that they did not recommend the use of Landolt rings for literates is probably because testing with letters is simpler and quicker.

SPECIFICATION AND GRADATION OF SIZES

Another subcommittee of the Committee on Optics and Visual Physiology of the A.M.A., the Committee on Optotypes, in 1953[6] made the following recommendations.

1. For the designation of visual acuity, serious attention should be given at once to the adoption of the *visual angle of resolution* in minutes of arc of the component parts of the test letters of the chart. Such a designation is a direct statement of what is actually measured.
2. A geometrical progression in the sizes of the letters of successive lines of the chart is desirable.

Both of these recommendations are met in the proposed charts for testing far and near vision. Column 1 of Table 2 gives the visual angles subtended by the component parts of the letters and Landolt rings of both the far and near test charts. These comprise 15 sizes ranging from 16 to 0.65 minutes. They form a series in which the steps are approximately equal on a logarithmic scale with a gradation of 0.1 log unit. This means that each successively larger size is approximately 26 percent greater than the preceding one. Slight deviations from an exact geometric progression were introduced in order to maintain relatively simple numbers for the specifications in the visual angle and Snellen notations. Figure 1 shows the relationships between the selected intervals and the visual angles in logarithmic units.

Column 2 of Table 2 gives the Snellen notations for the letters and Landolt rings used at a distance of 20 feet. Figure 2 shows the

TABLE 2

SPECIFICATION OF SIZES OF OPTOTYPES AND NUMBER OF CHARACTERS OF EACH SIZE

Visual Angle in Minutes Subtended at Standard Test Distance* (20 ft., 14 in., 16 in.)	20 ft. (6.1 m.) A	14 in. (35 cm.) B	16 in. (40 cm.) C	Equivalent M Notation (distance in meters at which detail subtends 1′)			No. of Characters 20 ft. Chart†
				A	B	C	
16.0	(20/320) 12.5/200	14/224	40/640	97.5	5.6	6.4	—
12.5	(20/560) 16/200	14/175	40/500	76.5	4.4	5.0	—
10.0	20/200	14/140	40/400	61	3.5	4.0	1
8.0	20/160	14/112	40/320	48.8	2.8	3.2	2
6.25	20/125	14/87.5	40/250	38.2	2.2	2.5	4
5.0	20/100	14/70	40/200	30.5	1.75	2.0	6
4.0	20/80	14/56	40/160	24.4	1.4	1.6	6
3.0	20/60	14/42	40/120	18.3	1.05	1.2	8
2.5	20/50	14/35	40/100	15.25	0.875	1.0	10
2.0	20/40	14/28	40/80	12.2	0.7	0.8	10
1.5	20/30	14/21	40/60	9.2	0.524	0.6	10
1.25	20/25	14/17.5	40/50	7.6	0.44	0.5	10
1.0	20/20	14/14	40/40	6.1	0.35	0.4	10
0.8	20/16	(14/12) 17.5/14	(40/32) 50/40	4.9	0.28	0.32	10
0.65	20/13	(14/9.1) 21.5/14	(40/26) 61.5/40	4.0	0.23	0.26	10

* These visual angles apply to the component parts of the optotypes, that is, to the width of the lines. The over-all dimensions, as in the standard Snellen letters, are five times the above values.

† The near charts have 10 characters on each line.

two sides of the letter chart for use at this distance. In the Landolt ring chart, not shown, the letters are replaced by rings of the same size with openings above, below, right and left. Test characters larger than the 20/200 (10 minute) size are not provided because visual angles greater than 10 minutes are more conveniently obtained by a decrease in the viewing distance as indicated in Table 2. To permit precise measurement of acuities of 20/200 and poorer, auxiliary laminated cards are provided as shown in Figure 3. These have on each side either two letters or a single Landolt ring of size which subtends a visual angle of 10 minutes at a distance of 20 feet.

MEASUREMENT OF VISUAL ACUITY AT A NEAR DISTANCE

In the selection of test material for measuring acuity at a near distance it is important to keep clearly in mind the several different functions of such a test. In a routine ophthalmologic examination a reading card is useful in the final evaluation of the patient's glasses, to see whether the dioptic power of the reading addition is suited to his specific requirements. For this purpose accurate standardization of the test material and of the test conditions is not necessary since a precise and reproducible measure of visual acuity is not required. The examiner could use a book, magazine, or newspaper, a sheet of music, a needle and thread or whatever else best represented the patient's needs.

On the other hand, in those special cases requiring a precise measure of visual acuity at some near distance, specification of the

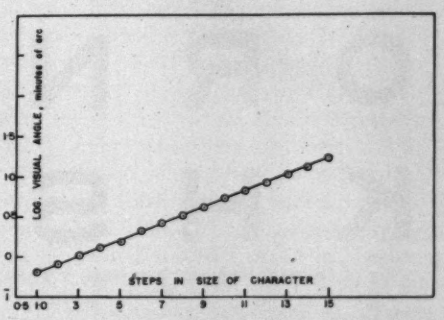

Fig. 1 (Sloan). Visual angles subtended by component parts of letter and by break in Landolt ring. The visual angles are expressed in logarithmic units to show that each successively larger size is approximately 0.1 log unit (26 percent) greater than the preceding one.

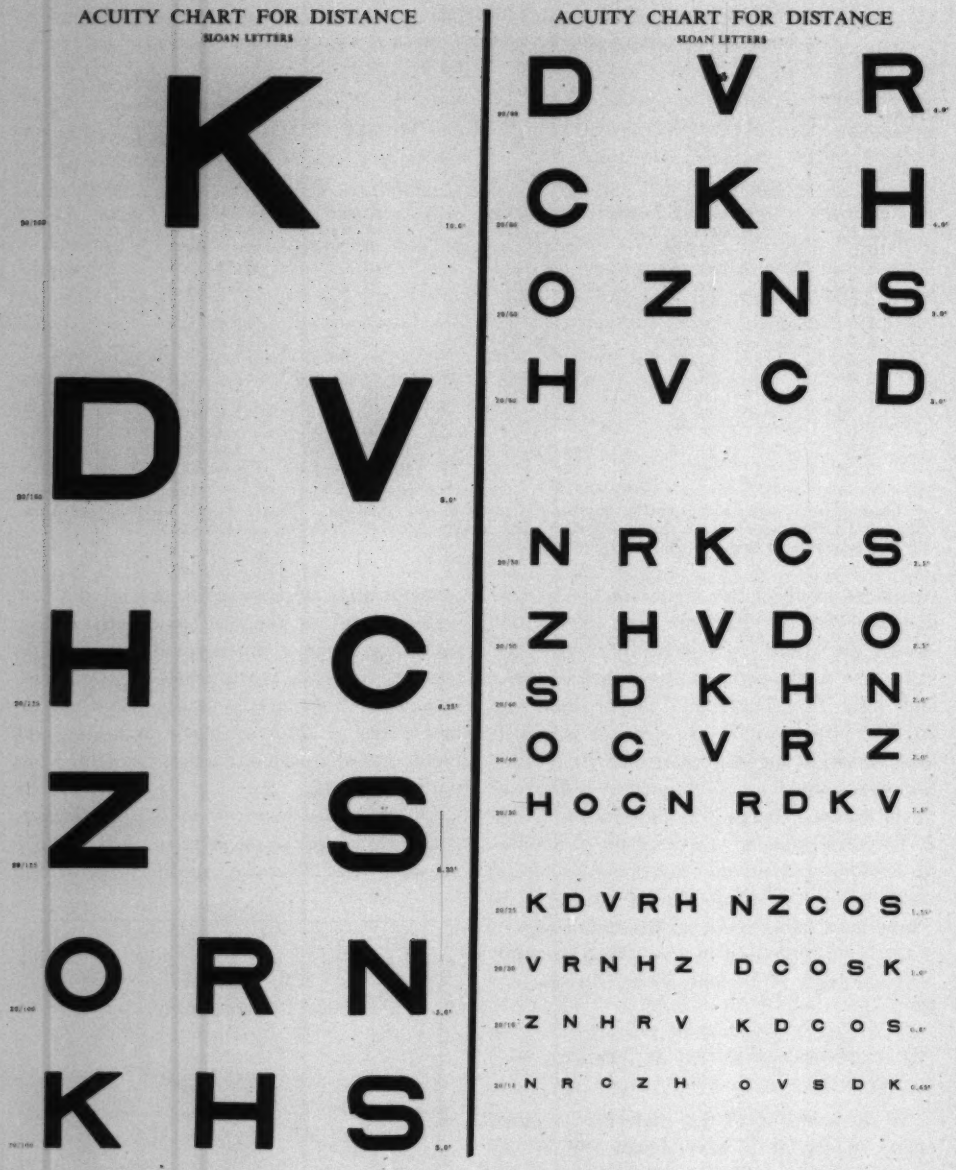

Fig. 2 (Sloan). Reduced photograph to show the two sides of the letter chart for use at 20 feet.

sizes of the test characters, their distance from the eye, the intensity of the incident illumination, and so forth are important. For many industrial jobs, the applicant is required to meet certain standards of visual acuity measured at both far and near distances.

When the error of refraction is adequately corrected for both distances the acuities should be essentially the same. Tests at the

two distances are therefore also of value to the ophthalmologist as a check on the refractive corrections for far and near. They may also prove useful when malingering is suspected. These needs are best met by test charts for a near distance which utilize the same optotypes and the same visual angles as those used in testing acuity at the 20 foot distance. The proposed letter and Landolt ring charts for use at a near distance of 14 inches are shown in Figure 4.

Distance at which near visual acuity should be measured

Adoption of a near distance of 40 cm. (16 in.) instead of the widely used 35 cm. (14 in.) viewing distance has the following advantages:

1. A distance of 40 cm., requiring 2.5 diopters of accommodation, corresponds more closely to normal reading and work habits[7] than does a distance of 35 cm. requiring 2.86 diopters of accommodation.

2. Snellen notations expressed in terms of a distance of 40 cm. are more easily converted to the corresponding notations for a distance of 20 ft. than are those expressed in terms of a testing distance of 14 in. For example, 40/250 is converted to its equivalent in visual angle at a 20 foot distance, namely 20/125, simply by dividing numerator and denominator by 2.

On the other hand, to convert 14/87.5 to its equivalent, 20/125, requires division of numerator and denominator by 0.7. Because certain visual requirements are now defined in terms of a 14 in. testing distance, it may not be feasible at the present time to discontinue entirely the use of this distance. Since, however, the master charts for the near tests will be reproduced photographically, it should be possible to provide separate charts for use at 14 and at 16 inches.

Visual angle and Snellen notations for near charts

Column 3 of Table 2 gives the Snellen notations for optotypes to be used at a near distance of 14 in. These subtend visual angles

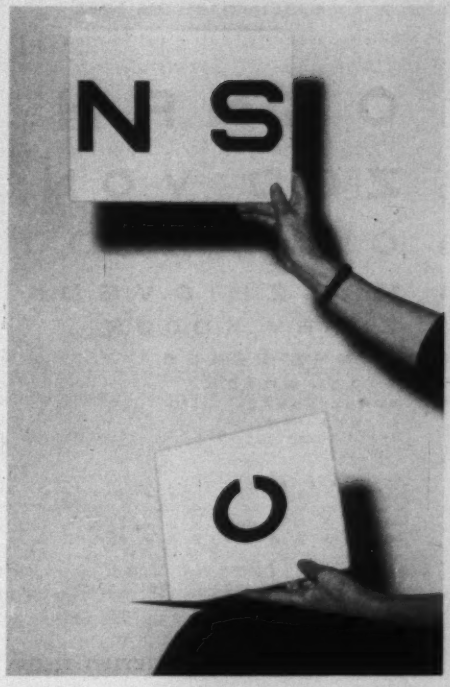

Fig. 3 (Sloan). Auxiliary laminated cards for measuring acuities of 20/200 (10 minutes) and poorer.

exactly equal to those used in measuring visual acuity at 20 ft. The two smallest sizes, 0.8 and 0.65 minutes, corresponding respectively to 20/16 and 20/13 at distance, are omitted in the near charts because of the practical difficulties of reproducing accurately these small test characters. In the rare instances in which visual angles smaller than 1.0 minute are needed in measuring near acuity, the testing distance may be increased. Thus, as indicated in the table, visual angles of 0.8 and 0.65 minutes may be obtained by viewing the smallest test characters from distances of 17.5 and 21.5 in. respectively instead of from a distance of 14 in. Snellen notations for a test chart to be used at 40 cm. (16 in.) are given in Column 4 of Table 2. With this chart visual angles of 0.8 and 0.65 minutes can be obtained by viewing the smallest test characters from distances of 50 and 61.5 cm. respectively instead of from the standard distance of 40 cm.

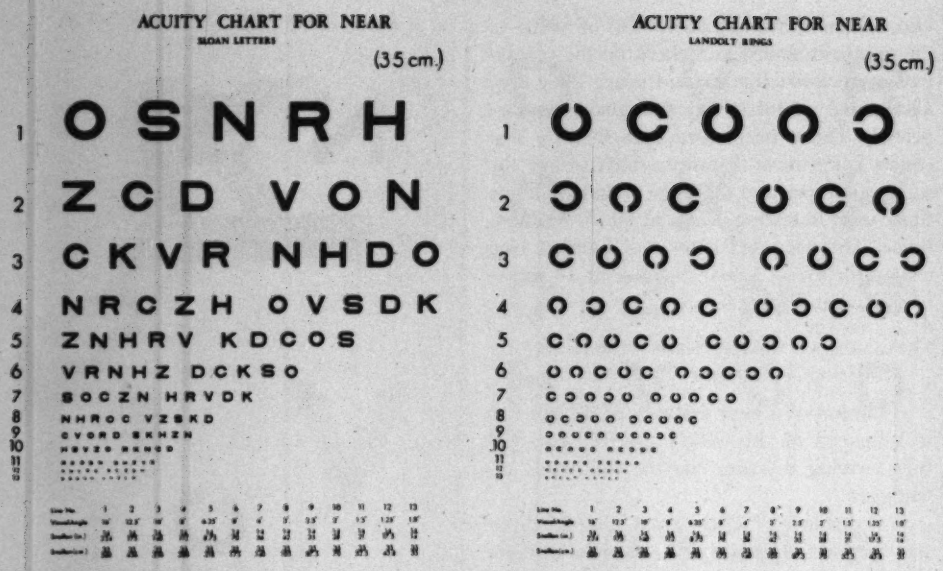

Fig. 4 (Sloan). Letter and Landolt ring charts for a near testing distance. The charts shown are of the size for use at 35 cm. (14 in.). For use at 40 cm. (16 in.) the letters an rings are 14 percent larger.

The M notation for specifying visual acuity

Another notation sometimes used to designate the sizes of test characters for measuring acuity specifies that distance in meters at which the component parts of a given test character would subtend a visual angle of one minute of arc. The M notation is convenient when some nonstandard testing distance is used. A 2.0 M letter, for example, when viewed at a distance of 10 cm. is equivalent to 10/200, that is 20 minutes in visual angle. M notations are given in columns 5 to 7 of Table 2.

Summary

Several committees of the A.M.A. have, in the past, made recommendations pertaining to the specification of charts for testing visual acuity:

1. In 1916 and again in 1930 it was recommended that, for testing literate subjects, letters be used which are of known difficulty in comparison with the Landolt ring.

2. In 1953 a Committee on Optotypes recommended that letter sizes be designated in terms of the visual angle in minutes of arc subtended by the component parts.

3. This committee and previous ones recommended a geometric progression in letter sizes, that is, equal steps on a logarithmic scale.

The charts described in this report for testing acuities at 20 feet and at a near distance fulfill all of the above recommendations. A special set of 10 letters is employed for testing literate subjects. These have been shown to give measures of visual acuity closely equal to those obtained with Landolt rings. For testing illiterate subjects, Landolt rings with breaks in horizontal and vertical locations are substituted for letters.

Eleven sizes of optotype between 1.0 minute (20/20) and 10 minutes (20/200) are provided for testing at 20 feet and at a near distance. The chart for use at a near distance has in addition two sizes larger than 10 minutes. At distance these larger visual

angles are obtained by a decrease in testing distance. Additional letters and rings are provided on laminated cards for convenient use at distances shorter than 20 feet.

The charts for testing visual acuity at a near distance include alternate forms for use at standard distances of 14 and 16 inches (35 and 40 cm.). It is recommended by this subcommittee that 40 cm. be adopted as the standard for testing visual acuity at a near distance.

The Johns Hopkins Hospital (5).

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CONGENITAL TOXOPLASMOSIS*

IV. CASE FINDING USING THE SKIN TEST AND OPHTHALMOSCOPE IN STATE SCHOOLS FOR MENTALLY RETARDED CHILDREN

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Human congenital toxoplasmosis varies in its effects from widespread meningoencephalitis with hydrocephalus and early death to infection clinically unrecognizable except for inflammation of the retina and choroid in one or both eyes. Indeed, it is likely that some cases are completely inapparent, even the eyes being spared. Which course the infection chooses to pursue depends upon the virulence of the particular strain of parasite, the reaction of its host and the stage of development of the fetus.

Recently reported clinical studies[1,2] suggest that the lesser forms of congenital toxoplasmosis outnumber cases of the better known complete syndrome characterized by internal hydrocephalus or microcephaly, convulsions, intracerebral calcifications, mental retardation, chorioretinitis and microphthalmos (figs. 1 and 2). Actually, the final result of congenital infection is related to the extent and location of central nervous system and ocular involvement; the more prolonged and severe the inflammation, the greater the damage to be expected.

The work being reported is part of a larger study concerned with the incidence of congenital toxoplasmosis. The expected incidence of the disease can be estimated from the frequency of past or persistent infection in the general population as evidenced by immunologic and serologic tests. Support for such a figure must come from observation of the various clinical forms of the disease. The complete syndrome as originally described[3] is relatively uncommon. Surveys of state schools for the blind[4] uncover a considerable number of those cases

* From the Division of Ophthalmology, Department of Surgery, Medical College of Georgia. This study was supported by grants from the Knights Templar Eye Foundation and the United States Public Health Service. Completion of the work was aided by a grant from the United Cerebral Palsy Research and Educational Foundation, Inc.

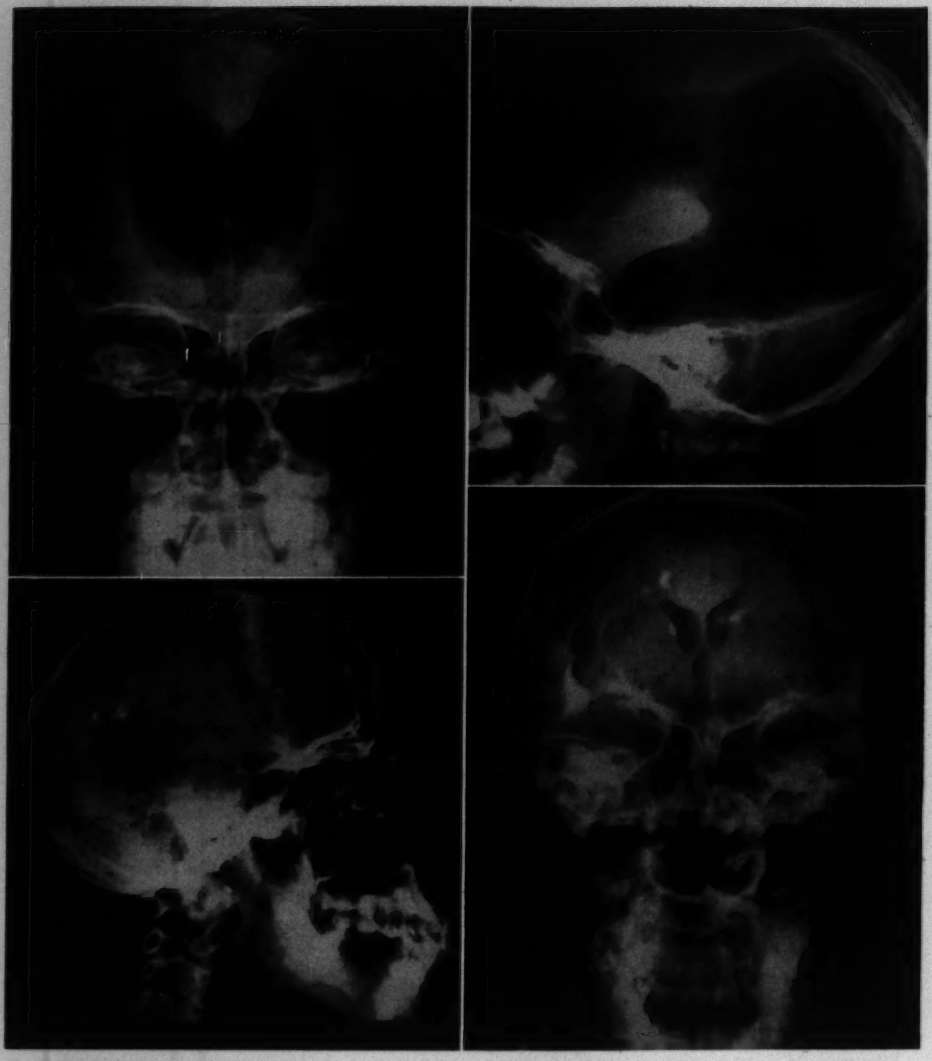


Fig. 1 (Fair). Hydrocephalus and intracerebral calcifications of congenital toxoplasmosis.

in which only the eyes are seriously involved. Probably the commonest situation is that in which only one eye is affected, such cases being seen in eye clinics or found during routine physical examinations.

Mental retardation is always mentioned in any discussion of the effects of congenital toxoplasmosis. One might expect, then, to find examples of the congenital infection grouped in schools for mentally retarded children. It is the purpose of this paper to record the results of the examination of 1,700 such children in a case-finding study using the skin test for toxoplasmosis and the ophthalmoscope. Clinical and serologic aspects of the problem will be discussed.

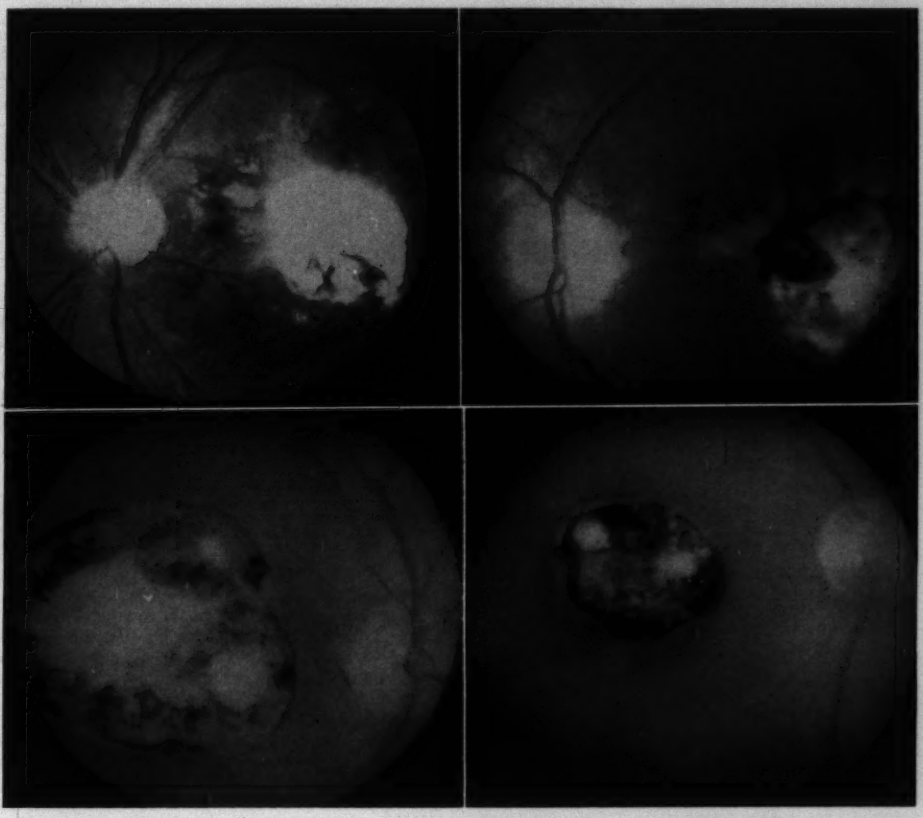


Fig. 2 (Fair). Four examples of the central chorioretinitis of congenital toxoplasmosis.

Procedure

The most constant finding in congenital toxoplasmosis is chorioretinitis.[5] Typically, the ocular inflammation is bilateral and involves each macula. Many of the less severely affected cases show a healed central chorioretinitis in one eye but only peripheral scars in the other so that useful vision is preserved. In most children, however, in whom the meningo-encephalitis was severe enough to produce mental retardation, there is a bilateral central chorioretinitis. This sign is reliable enough to be used in case finding. In addition, the squint and nystagmus that accompany poor central vision help to call attention to these children.

The difficulty of ophthalmoscopic examination in mentally retarded children need hardly be described. In this particular study, however, inability of the children to cooperate was no problem. Retarded children, like very young normal children, persist in looking at the examiner's light which is just what is needed for visualization of the macula. Pupils were dilated in all cases so that there was little possibility of failing to recognize central chorioretinal lesions.

In the first 1,000 children examined, the skin test for toxoplasmosis was performed initially. Those children with positive skin tests were then examined with the ophthalmoscope. This left open the possibility that cases of chorioretinitis were being missed in those children with negative skin

tests. In the next 700 children, then, ophthalmoscopic examination was performed first, only those children with chorioretinitis being skin tested. Dye tests for toxoplasmosis were done on each child with chorioretinitis and an attempt made to locate the mother for serologic study in each such case. Skull X-ray films were obtained also, and the matter of convulsive seizures investigated.

Results

Using the method described, eight children were found with central chorioretinitis considered typical of congenital toxoplasmosis. All were retarded, of course, and several showed other signs of the disease. In two additional cases, the diagnosis seemed likely but somewhat less certain. All cases of chorioretinitis gave positive skin and dye tests for toxoplasmosis so that screening with the skin test seems to be a reliable procedure in such a study. Among the 1,000 children screened with the skin test, four probable and one doubtful case were located. When the ophthalmoscope was used in screening the next 700 children, the same number of cases were found—four probable and one doubtful. If the ophthalmoscope is to be used first, a certain amount of judgment is required in separating out the cases of congenital syphilitic chorioretinitis, the hereditary degenerations and the cases of traumatic chorioretinitis that turn up to confuse the issue.

In several children (with positive skin tests) small pigmented peripheral chorioretinal scars were noted which were not considered characteristic of anything in particular and so were disregarded except that these individuals were eliminated completely in calculating the percentage of all inmates with positive skin tests. One mongoloid child was found with a juxtapapillary healed chorioretinitis. Although her skin test was positive, she was eliminated from consideration. Congenital toxoplasmosis has been suggested as a cause of mongolism[6] but in the more than 100 mongols examined in this study, no other case of chorioretinitis was found. Further, positive skin tests for toxoplasmosis were no more frequent in mongols than in the inmate population generally.

A brief description of those cases of probable congenital toxoplasmosis located in this study follows:

Case reports

Case 1

Twenty-year-old woman, complete mental and physical invalid; microcephaly, intracerebral calcifications, frequent generalized convulsive seizures, marked microphthalmos right eye, central and peripheral healed chorioretinitis, left eye. Skin test weakly positive, dye test positive 1:256.

Case 2

Twenty-three-year-old woman, low-grade moron, bilateral healed central chorioretinitis, intracerebral calcifications. Skin test strongly positive, dye test positive 1:256.

Case 3

Twenty-four-year-old woman, low-grade moron, bilateral healed central chorioretinitis, generalized convulsive seizures. Skin test strongly positive, dye test positive 1:256.

Case 4

Ten-year-old girl, high-grade moron, bilateral healed central chorioretinitis. Skin test strongly positive, dye test positive 1:1024.

Case 5

Thirty-seven-year-old woman, high-grade moron, bilateral healed central chorioretinitis, intracerebral calcifications. Skin test mildly positive, dye test positive 1:32.

Case 6

Eighteen-year-old girl, high-grade moron, bilateral healed central chorioretinal scars. Skin test strongly positive, dye test positive 1:64.

Case 7

Twelve-year-old girl, high-grade moron, bilateral healed central chorioretinitis. Skin test strongly positive, dye test positive 1:64.

Case 8

Thirty-one-year-old woman, very low-grade moron, blind painful right eye removed years before, large healed central chorioretinal scar in the left eye. Skin test strongly positive, dye test positive 1:128.

The two doubtful cases will be described separately:

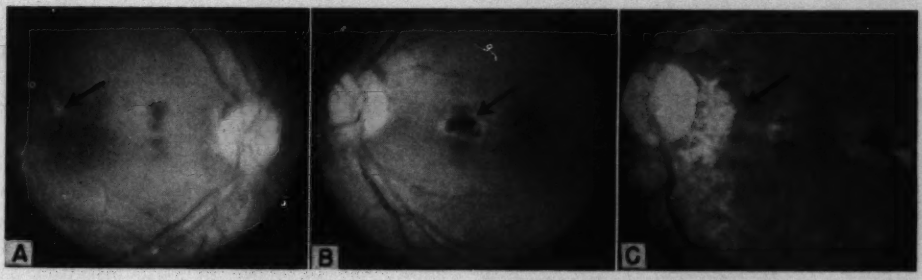


Fig. 3 (Fair). The fundi in Case 9 are shown in (A) and (B). The arrows indicate the chorioretinal scars. In (C) is shown an area of choroidal sclerosis in another eye similar to the left eye as described in Case 10.

CASE 9

Sixteen-year old girl, high-grade moron, bilateral healed central chorioretinitis, minimal in degree of severity. The central chorioretinal scars were small but definite and suggested nothing but an inflammatory origin (figs. 3a and 3b). No peripheral scars were seen. Skin and dye tests for toxoplasmosis were positive. There was no history of convulsions. Skull X-ray films were normal. The patient's mother is an inmate in a state insane asylum, suggesting hereditary disease. The only real reason for considering this case is the presence of bilateral central chorioretinitis. The reliability of this sign has already been mentioned and will be considered further in the discussion to follow.

CASE 10

Fifty-eight year old man, low-grade moron. An advanced senile cataract in the right eye prevented any view of the fundus. There was no external sign of past inflammation. On the left were seen a few small exudates floating in the vitreous and a large central chorioretinal disturbance which appeared to be inflammatory in origin. Skin and dye tests for toxoplasmosis were positive. A complicating factor was the presence of an area of choroidal sclerosis alongside the temporal aspect of the nervehead exactly like that indicated by the arrow in another case shown in Figure 3c. This is a senile change and probably was unconnected with the central retinal lesion. However, the age of the patient, the senile cataract in the right eye and the signs of vascular sclerosis in the left eye do raise the question as to whether or not the central chorioretinal disturbance might have been vascular in origin. In my opinion it was not, as judged by its appearance. If the right eye could have been seen into, the question would probably have been settled. In this connection, I have seen cataract of the senile variety come on relatively early in patients with congenital chorioretinitis. Still, this particular case must be considered doubtful.

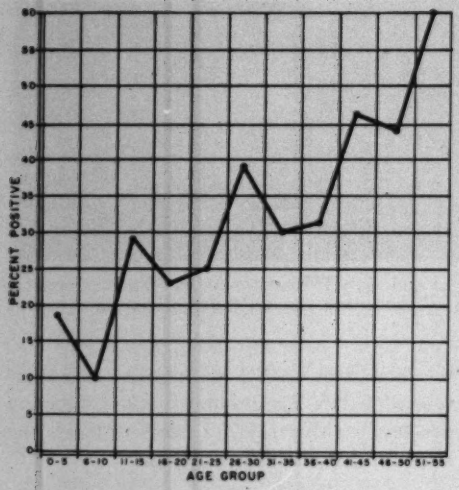
Three of the mothers were dead. Two of the others have been located. The dye test in the mother in Case 2 was positive in a dilution of 1:256. The mother in Case 4 gave a dye test positive 1:512. Efforts to locate the remaining five mothers continue.*

DISCUSSION

The diagnosis of congenital toxoplasmosis cannot be made with certainty in any older child on the basis of congenital chorioretinitis and positive serologic tests for toxoplasmosis in patient and maternal parent. Cases of congenital chorioretinitis not due to toxoplasmosis are known to occur and there is always the possibility that both mother and child have *acquired* toxoplasmosis at some time or other during their lives. For this reason, the cases listed in this study are described as "probable" only. However, eight or nine of 10 cases of congenital central chorioretinitis are associated with positive skin and blood tests for toxoplasmosis in both patient and mother so it is very likely that the children described are examples of the congenital infection, especially since several of them showed other classical signs of the disease in addition to chorioretinitis and mental retardation.

At the outset of this investigation it was hoped that more than the usual amount of diagnostic importance might be attached to positive skin tests for toxoplasmosis in men-

* Since this report was submitted for publication, dye tests have been reported positive in the mothers of the patients in Case 1 and Case 9.



Graph 1 (Fair). Results of skin test for toxoplasmosis in 993 inmates of state school for mentally retarded children (cases of congenital toxoplasmosis and inflammatory eye disease eliminated).

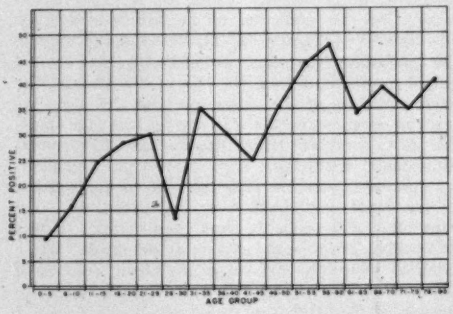
tally retarded children because of the more or less isolated nature of their existence. Although millions of people acquire toxoplasmosis yearly, we are completely ignorant of the means of its transmission. It would seem that the incidence of acquired toxoplasmosis might be low in an institution for mentally retarded children where the inmates are largely cut off from the rest of the world. Contacts with outsiders and with insects and pet animals are relatively few. If acquired toxoplasmosis were actually less in such institutions, then in any individual case a positive serologic test for toxoplasmosis would be more likely to be the result of congenital infection and so would be more significant in any search for congenital cases.

Such thoughts are not borne out by the results of this study. Positive skin tests were encountered infrequently in those children confined constantly in bed but were common in older children able to work in and about the school or on the school farm. In addition, there was a great variation in the number of positive skin tests seen from one cottage to another in which the children are up and about but incapable of performing regular work. The over-all rate of positive skin tests was finally determined to be the same that might be expected in the general population.

The frequency of positive skin tests for toxoplasmosis in the various age groups in one school for mentally retarded children is shown in Graph 1. For comparison Graph 2 shows the incidence of past infection as measured with the skin test in the general population of the same geographic area. It may be seen immediately that in this respect there is no significant difference between the two groups.

Probable cases of congenital toxoplasmosis accounted for approximately 0.5 percent of the retarded children studied. This figure does not help us directly in any attempt to determine the over-all incidence of the disease because we do not know how often the congenital infection results in mental retardation. Eventually, as the pattern of congenital toxoplasmosis develops, mental retardation will take its place along with the other signs of the disease in their proper order of importance.

Although few in number, cases characterized by mental retardation form an important link between the even more severe forms of congenital toxoplasmosis and those cases in which only the eyes are seriously



Graph 2 (Fair). Results of skin test for toxoplasmosis in 883 general hospital cases (cases of congenital toxoplasmosis and inflammatory eye disease eliminated).

involved. That is, one can connect the complete syndrome with its hydrocephalus, intracerebral calcifications, convulsions and chorioretinitis with the somewhat less severe form, showing only mental retardation and chorioretinitis with perhaps convulsions or intracerebral calcifications to strengthen the clinical diagnosis. Thence one may proceed to those cases of mental retardation and chorioretinitis, or chorioretinitis and intracerebral calcifications, or chorioretinitis and convulsions and finally, to those in which chorioretinitis is the only clinical manifestation of the disease.

The two findings that link together the widely differing forms of congenital toxoplasmosis are chorioretinitis—typically bilateral and central—and positive serologic tests for toxoplasmosis in mother and offspring. As yet, we are unable to limit the clinical manifestations of the disease. At one extreme may lie some previously unexplained spontaneous abortions and premature births, while the other end of the picture may eventually extend to include unilateral peripheral congenital chorioretinitis or even some cases that are completely inapparent as far as clinical examination can tell.

Summary

A total of 1,700 inmates in state schools for mentally retarded children were screened for the central chorioretinitis of congenital toxoplasmosis, using the skin test and ophthalmoscope. Eight probable and two possible cases were found. All gave positive skin and Sabin-Feldman dye tests for toxoplasmosis. The clinical and serologic aspects of the problem are discussed.

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TESTING HIGHER VISUAL FUNCTIONS

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Visual functions can be divided into peripheral, formative, and psychological. (Please refer here to Table 7 [after Duke-Elder].) Although disturbed peripheral visual function can be exactly localized anatomically, this is not so with higher visual functions because of extensive overlap between adjacent areas and multiplicity of function. These higher visual disorders are often associated with disorders of speech, hearing, reading, and writing.[2] Because of these complications the ophthalmologist often is either unaware of or unwilling to test more than the peripheral visual functions.

A simplified screening test of higher visual function is not to replace but rather to complement a neurologic examination.

Though visuosensory disorders may either be complete or partial, they seldom exist in pure form and tend to be mixed with associa-

TABLE 1

SUMMARY OF VISUOSENSORY DISORDERS

VISUOSENSORY DISORDERS	
CORTICAL BLINDNESS (Complete)	PRIMARY (Partial)
1. Blindness, i.e. loss of light perception	I. Color sense —associated with light and form
2. Psycho—optical reflexes disappear —fixation reflex —fusion reflex —visual blink reflex —reflex (not voluntary) convergence —accommodation	II. Space appreciation —coronal plane
3. Retention visual memory and orientation	SECONDARY
4. Retention pupillary reaction to light	I. Form and contour —metamorphopsia
5. Retention voluntary convergence and normal eye movements	II. Stereoscopy
6. Normal ophthalmoscopic picture	III. Form visual patterns ?
	IV. Visual extinction

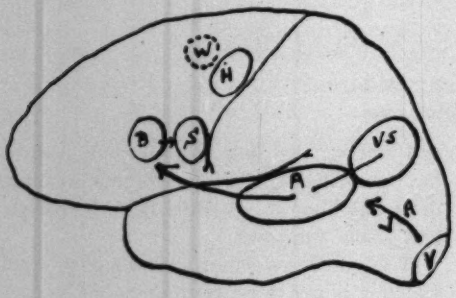
TABLE 2

ASSOCIATIONAL DISORDERS

AGNOSIA (See—Not Recognize) (Sensory)	APRAXIA (Inability to transform an intended movement into practical effect) (Motor)
I. Object	I. Ideational —No plan
II. Color	II. Ideomotor —Confused
III. Space (disorientation)	III. Constructional —Inability to copy
IV. Corporeal (body image)	IV. Motor —No Fine Movements
V. Labyrinthine and cerebellar disorientation	

TABLE 3

APHASIA



V: Visual (calcarine) cortex
VA: Visual association area
VS: Visual speech area (alexia)
A: Auditory speech area (complete sensory aphasia)
B: Motor speech area (vocal aphasia)
S: Motor speech area for muscles of speech
W: ? Motor writing area (agraphia)
H: Motor area for hand movements

MOTOR	SENSORY
1. Verbal	1. Word deafness
2. Agraphia (writing)	2. Alexia (word blindness)
	3. Semantic (meaning)
	4. Developmental

tional disorders.[3] With this in mind visuosensory disorders[4–6] can be summarized as in Table 1.

Associational disorders[7–9] are either sensory (agnosia) or motor (apraxia) (table 2). All can be complete or partial.

TABLE 4

TESTING OF HIGHER VISUAL FUNCTIONS

TESTS	TO DETERMINE
A. RECEPTIVE:	
1. *Object* (form and contour)	
1. Name familiar objects	Simple recognition
2. Describe complex scene	Form, contour and pattern vision
2. *Color*	
1. H-R-R color plates	Partial recognition of colors
2. Color field (red)	Hemiachromatopsia
3. *Space*	
A. Visual Localization	
1. Name right and left sides (of patient) (of picture)	Corporeal agnosia, unilateral agnosia Defective relation of objects to patient
2. Point—grab	Coronal plane (past) (pointing)
3. Distance of objects from patient	Saggital plane
4. Simultaneously stimulate both sides of visual field	Visual extinction
B. Stereoscopy	
C. Topographical memory—describe familiar route or scene	
D. Labyrinthine and cerebellar disorientation—reproduce simple drawing	Inclination of objects to one side or inability to reproduce curves
B. EXPRESSIVE:	
1. *Apraxia*	
A. Simple order	
B. Complex order	Confused, repetitive. Fine movements difficult
C. Diagram spontaneously, copying	Constructional apraxia
2. *Aphasia*	
A. Motor	
1. Produce spoken words and sentences	Verbal aphasia
2. Ability to write with *either* hand (spontaneous, dictation, copy)	Agraphia
B. Sensory	
1. Appreciate meanings of spoken words	Verbal amnesia
2. Appreciate meanings of written words	Alexia
3. Appreciate meanings of (sentences, etc.)	Semantic aphasia

TABLE 5

EXAMINATION OF PERIPHERAL VISUAL FUNCTIONS (CASE R.S.A.)

External structures, Muscle balance, Pupils, Tension, Color vision, Media: Normal

Fields 2/1000 mm. white moderate concentric peripheral constriction
4/1000 mm. red

	VISION *Without correction*		*Cycloplegic refraction*	VISION *With correction*	
	Distance	*Near*		*Distance*	*Near*
Right eye	20/300	—	+5.75 D. sph. −1.0 D. cyl. ax. 10°	20/60	A-10
Left eye	20/300	—	+5.75 D. sph. −1.5 D. cyl. ax. 165°	20/70-1	A-10

FUNDI: Normal except for both discs which showed a gray pallor, deep physiological cups (at the bottom of which the lamina cribrosa was clearly visible) and a sharp outline.

TABLE 6

HIGHER VISUAL FUNCTIONS (CASE R.S.A.)

TESTS	TO DETERMINE
I. RECEPTIVE:	
1. OBJECT	
Named chair, table, coin etc.	Simple recognition
Unable to describe complex scene	Pattern vision
2. COLOR	
1. Normal on H-R-R color plates	Recognizes colors
2. Color field (red) full	No hemiachromatopsia
3. SPACE	
A. Visual localization	
1. Could name right and left sides of patient and of picture	
2. Accurate pointing	
3. Fair judge of distances	
4. Simultaneously stimulate both sides of visual field	Left sided inattention hemiamblyopia
B. Stereoscopy—3-D house fly—normal	
C. Topographical Memory—could describe route to hospital	
D. Poor balance but could reproduce curved lines	Cerebellar function
II. EXPRESSIVE:	
1. APRAXIA	
A. Simple order	
B. Complex order	Difficulty with fine movements
C. Could not diagram or copy well (had previously been amateur artist)	Constructional apraxia
2. APHASIA	
A. Motor	
1. Normal speech	
2. Unable to write	Agraphia
B. Sensory	
1. Could appreciate simple spoken words only	Verbal aphasia
2. Unable to read any but simple words, no sentences	Alexia

Aphasia[1] is a "disturbance of cerebral mechanisms subserving propositional and symbolic thinking and expression" and is truly an associational disorder but because of the numerous aspects involved (sensory, ideational, or motor) is usually considered separately (table 3).

With this brief summary, the magnitude of the problem of testing higher visual functions becomes apparent. The following test (table 4) was drawn up, not as an exhaustive (and exhausting) test of cerebration but to give the examiner some idea of the extent of the lesion and what particular channels would have to be pursued further.

CASE REPORT

This 26-year-old man (R. S. A.) was seen January 6, 1958, with a history of a depressed skull

TABLE 7

VISUAL FUNCTIONS (CASE R.S.A.)

PERIPHERAL Reception of stimuli	FORMATIVE Patterned awareness of sense data	PSYCHOLOGICAL Linkage with other patterns
	APPERCEPTION	ASSOCIATION
Retina→Calcarine Cortex	Experience Attention	
	Visuo-Sensory Disorders	*Associational Disorders*
1. Bilateral partial optic atrophy	1. Poor pattern vision 2. Visual extinction—left sided Inattention hemiamblyopia	1. Constructional apraxia 2. Agraphia 3. Alexia

fracture following a blow on the cranium by a falling piece of timber on July 3, 1956. After surgical elevation of the fracture and four days in coma, the patient slowly recovered through stages of spastic quadriplegia and left hemiplegia. On September 19, 1957, a cranioplasty of the skull defect was carried out, without incident.

The patient's cerebral cortical function (from our point of view) progressed from nonrecognition of family and familiar objects, noted shortly after the accident, to gradual return of recognition and speech. He was referred for ophthalmologic assessment because, in spite of apparently satisfactory spectacles (since November, 1956) he was unable to read.

Examination of his peripheral visual functions is shown in Table 5, and may be summarized as partial optic atrophy with some constriction of his visual fields. The tests of the patient's higher visual functions are shown in Table 6, and his visual functions can be summarized by referring to Table 7.

Summary

1. A simplified method of testing higher visual functions with a sample case has been presented.

2. Higher visual functions are considered as visuosensory disorders and associational disorders.

3. These visual functions are determined by a series of tests and questions in the form of tables.

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BUCCAL VARIDASE IN OPHTHALMOLOGY*

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Streptokinase-streptodornase was first used topically for enzymatic debridement of surface lesions and for the dissolution of loculated accumulations of pus and blood. Introduced for intramuscular use it revealed a salutary effect upon the healing of inflammatory lesions. The inflammatory reaction to infection normally results in localization or "walling off" of the infection or damaged areas by a defense curtain. However, the availability of antibacterial agents eliminated the necessity of much of this inflammatory defense mechanism. In fact, recovery is retarded by such isolation and protection of micro-organisms from blood-borne antibiotics. The body normally produces enough fibrolysin or plasmin to resolve local fibrin

* The Varidase was supplied by the Lederle Laboratories Division, American Cyanamid Company.

deposits. Thus small isolated and localized thrombi, within the vessels, are dissipated. Plasmin activated by tissue kinase resolves normal fibrin deposition. Larger deposits of fibrin and their prolonged retention (as in thrombosis and thrombophlebitis) which lead to extensive scar tissue necrosis, cannot be readily disposed of by normal bodily activity.

Streptokinase activates a plasminogen-plasmin mechanism in the euglobulin fraction of the blood serum. Plasmin, as a physiologic fibrinolytic agent, causes lysis of the fibrin in the thrombi and in edema of inflammation. The liquefaction of the thrombi in the arterioles improves the local circulation, allowing greater oxygenation of the involved area. Fibrinolysis, in vessels draining the affected area, assists in resorption of the fluid of edema. Elimination of the inflammatory barriers permits access to the diseased tissue of phagocytes, antibiotics and antibodies.

Intramuscular streptokinase has been effective in various inflammations, traumatic and surgical conditions, such as abscesses, cellulitis, edema, epididymitis, hemarthrosis, sinusitis and thrombophlebitis. It has also prevented excessive postoperative inflammation in eye enucleations.* It was also reported of value in two cases of retinal vein thrombosis, but of no value in conjunctivitis. The availability of buccal streptokinase in tablets of 10,000 units (Varidase) and its ease of administration stimulated its experimental use in a number of ophthalmic conditions. Buccal Varidase (tablets) when placed against the buccal mucosa, is presumed to penetrate the mucosal barrier and to enter the blood stream. Streptokinase is derived from the streptococcus. The theory of its action is attractive enough to warrant its study in ophthalmic diseases resistant to treatment. It is anti-inflammatory by virtue of its activation of the plasminogen-plasmin system. This, in turn, lessens the stasis of inflammation by removing fibrin clots and depolymerizing the macromolecular free fibrin proteins. As a result there is a thinning of the exudate, and an increase of tissue permeability, with resultant decrease of inflammatory edema. Fibrin deposition may be a causative factor in the phenomenon by which leukocytes adhere to the capillary endothelial wall in inflammation.

For its anti-inflammatory and fibrinolytic attributes buccal Varidase was used in 41 cases as follows: occlusion of central retinal artery, five cases; thrombosis of central retinal vein, three cases; diabetic retinopathy with retinal and vitreous hemorrhages and retinal miliary aneuryams, 10 cases; choroiditis, chronic, exudative, of undetermined etiology and due to toxoplasmosis, eight cases; iridocyclitis, chronic, infectious and due to toxoplasmosis, five cases; hyphema, traumatic, two cases; vitreous hemorrhage, hypertensive and of undertermined etiology, three cases; hemorrhage, subconjunctival, spontaneous, case undetermined, three cases; hemorrhage subcutaneous, traumatic, two cases.

The cases of choroiditis and diabetic retinopathy were associated with vitreous hemorrhages and exudative changes. Table 1 demonstrates the results of treatment.

Varidase treatment consisted of four buccal tablets daily for a period of two weeks in all cases, except those of subconjunctival and subcutaneous hemorrhage. The previously recommended dosage of Varidase for various conditions with 10,000 units twice daily for three to four days.

Résumé of Results

In the cases of occlusion of the central retinal vessels, appropriate courses of anticoagulants, such as heparin and dicumarol, were also prescribed. In the cases of arterial occlusion, no improvement was observed. Two cases of retinal vein thrombosis showed some improvement. However, since these cases have a fair incidence of recovery, even untreated, it is difficult to determine the

* Miller, J. M., et al.: The use of antibacterial drugs and streptokinase. Arch. Ophth., **57**: 241-244 (Feb.) 1957.

TABLE 1
RESULTS OF TREATMENT

Diagnosis	No. of Cases	Improved	Not Improved
Occlusion central retinal artery	5	0	5
Thrombosis central retinal vein	3	2	1
Diabetic hemorrhagic retinopathy	10	0	10
Choroiditis chronic exudative			
etiology undetermined	6	1	4
toxoplasmosis	2	1	2
Iridocyclitis chronic			
infectious	4	1	3
toxoplasmosis	1	0	1
Hyphema anterior chamber traumatic	2	2	0
Vitreous hemorrhage			
hypertension	2	1	1
cause undetermined	1	1	0
Subconjunctival bulbar hemorrhage traumatic	3	2	1
Subcutaneous hemorrhage traumatic	2	2	0
TOTALS	41	13	28

degree of improvement attributable to the Varidase.

The retinopathy in the diabetic patients failed to respond favorably to Varidase therapy, though the vitreous opacities seemed to lessen. The infectious conditions, choroiditis and iridocyclitis, were also treated with appropriate and extensive courses of antibiotics and steroids in conjunction with the Varidase. Two of eight patients with choroiditis were moderately improved while on Varidase alone. One of these was due to toxoplasmosis. One of the five patients with iridocyclitis improved. Two of three patients with vitreous hemorrhages were moderately improved with Varidase. One of several cases of vitreous opacities of recent origin improved while on Varidase therapy. Responding favorably to the streptokinase treatment were the two cases of hyphema of the anterior chamber and the two cases of subconjunctival and subcutaneous hemorrhages. These latter cases were traumatic in origin.

CONCLUSION

Forty-one cases of various ophthalmologic conditions were treated with buccal streptokinase-streptodornase (Varidase). Recent traumatic cases of hyphema, subconjunctival and subcutaneous hemorrhages improved with such treatment. Vitreous hemorrhages, choroiditis and iridocyclitis were less definitely benefited.

55 East Washington Street (2).

IRIDOMA IRIDES AND NEVI OF THE IRIS AND ANTERIOR BORDER LAYER

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In a previous study 11 tumors of the iris available in the collection of the Ophthalmic Hospital in Amsterdam were described by Salim in his thesis.[1] In spite of the varying structure it could be concluded on the ground of general pathologic characteristics that neurogenic aspects could be traced in all of them. This finding was comparable to the conclusions of Dvorak-Theobold,[2] Nordmann and Brini,[3] Westerveld-Brandon[4] in choroidal melanoblastoma.

A further analysis of Case 9 (P.A. 1283) was prepared in collaboration with Dr. van Dam, pathologist, and Mr. Lammens, technician. This tumor was described by van Heuven[5] as leiomyoblastoma since in addi-

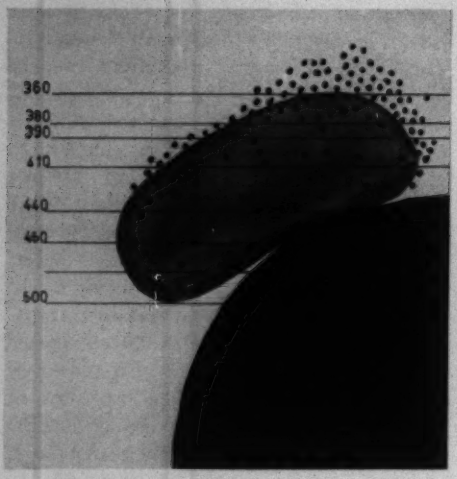

Fig. 1 (Hagedoorn and Salim). P. A. 1283. Reconstruction of tumor area with section numbers, showing locations of sections in Figures 2 through 9 and 11 and 12.

tion to a leiomyoma other associated anomalies were found. It was labelled iridoma by Salim on the same grounds since these associated anomalies had to be considered specific for the iris. The case history follows:

Case history

The patient, a woman, aged 54 years, visited her ophthalmologist for a routine examination. The eyes were perfectly normal with good vision, but in the upper temporal quadrant of the right iris a "nevus" was seen. The tumor was only slightly prominent but extended from the border of the pupil to near the angle of the anterior chamber. It was diffusely darker than the normal iris tissue and the inferior margin seemed slightly swollen, pale and glassy. There were no signs of spreading of the well marked off tumor in the surrounding iris tissue. After a short observation the eye was enucleated since the glassy inferior part of the tumor apparently had increased in size.

In preparing the thesis the tumors were carefully studied with Prof. Zeeman and Dr. van Dam especially to detect whether or not neurogenic aspects could be traced. The fascinating problems of this case, however, did not appear fully solved and we studied serial sections and related anomalies.

In Figure 1 a reconstruction of the tumor (P.A. 1283) is given. Section 250 shows the first clear sign of a localized abnormal pigmentation of the anterior "mesodermal" layer of the iris caused by the presence of darkly pigmented cells. These cells have considerably increased in number in section 390 (fig. 2). Besides chromatophores and unidentified pigmented cells, Koganei (clump) cells dominate the picture. Already in section 360 a not or scarcely pigmented tissue appears, consisting of long stretched cells generally arranged parallel to the surface of the iris (section 380, fig. 3). In sections 430 and 440 this tissue largely constitutes the anterior part of this region of the iris extending from the periphery, close to the angle of the anterior chamber, to the pupillary mar-

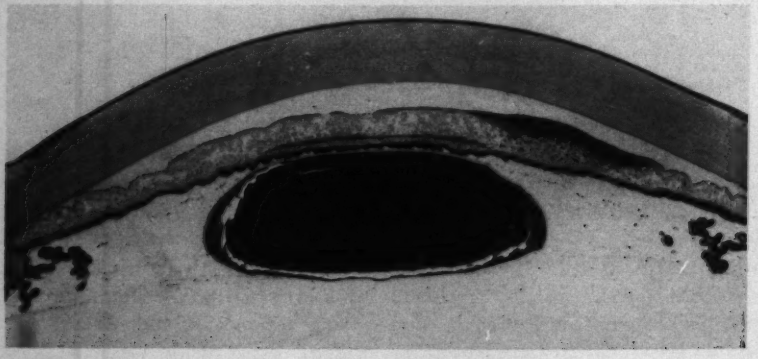

Fig. 2 (Hagedoorn and Salim). P. A. 1283, section 390, ×12. Peripheral pigmented part of the anomaly.

Fig. 3 (Hagedoorn and Salim). P. A. 1283, section 380, ×360. Nonpigmented or only slightly pigmented tissue: Koganei cells.

gin, where it is continuous with a tumorlike extension (fig. 4).

This tumor (fig. 5) consists of long stretched cells, packed closely together. A minority is seen on transverse or more oblique section. There are no distinct cell borders and with the hematoxylin-v. Gieson technique the cells stain identical to the sphincter muscle cells. The protoplasm contains very delicate fibrillae arranged along the long axis of the cells. They do not intermingle and do not stain with the Mallory technique. The nuclei are long and rod-shaped, with diffuse delicate chromatine without a

Fig. 4 (Hagedoorn and Salim). P. A. 1283, section 440, ×20. Central "leiomyoma" continuous with a cellular layer and (to the right) a pigmented part of the anomaly.

Fig. 5 (Hagedoorn and Salim). P. A. 1283, section 440, ×125. Leiomyoma continuous with an ectropionated sphincter.

nucleolus. In the more central part of the tumor a delicate membrane may surround the cells which gives a positive connective tissue reaction with the Mallory stain. In the superficial part clump cells are seen. This tissue was identified by van Heuven as leiomyoma. It is apparently continuous with an ectropionated sphincter. In further sections (480) it is also continuous with the described layer of cells, reminding one of the cells constituting the nevi irides as described by Fuchs[6] and the cells of the anterior border layer (fig. 6). Further on a number of isolated patches of similar structure "nevi" were found on the surface of the iris up to section 600. It should be added to this description that there is a considerable ectropion of the pigment layer, especially evident in the sections around 400 (fig. 5).

Comment

In previous publications the leiomyomatous nature of the tumor has been stated. In phase-contrast microscopy (Dr. van Dam)

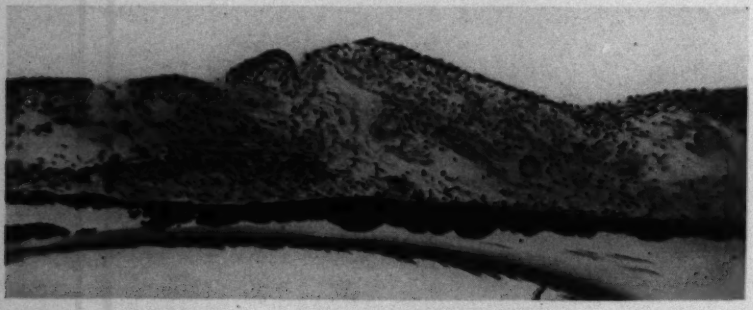

Fig. 6 (Hagedoorn and Salim). P. A. 1283, section 480, ×66. Peripheral part of tumor extends over the surface, suggesting a relation with the tissue of the anterior border layer and nevus tissue (Fuchs).

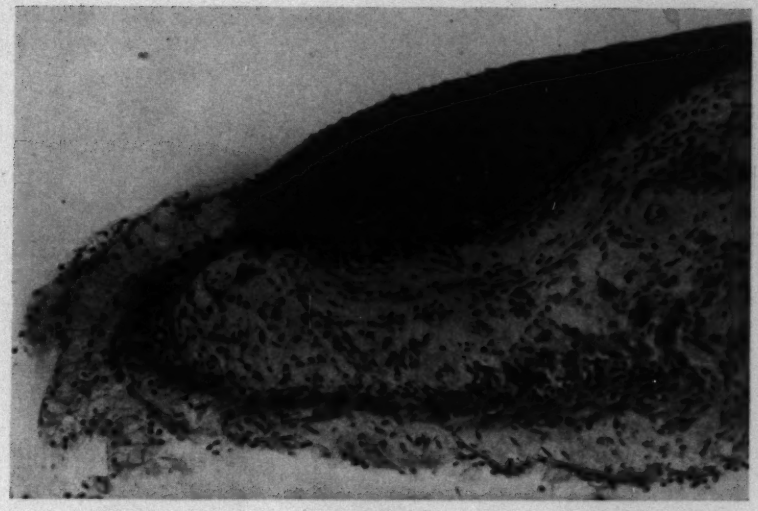

Fig. 7 (Hagedoorn and Salim). P. A. 1283, section 459, ×148. Tissue of leiomyoma is directly continuous with ectropionated sphincter (depigmented specimen).

no further evidence could be obtained. However, the direct continuity of the leiomyoma with the sphincter was obvious in a more central area (fig. 5), especially in a depigmented section (fig. 7). It may be considered conclusive evidence of a very close relationship between this part of the tumor and the sphincter tissue, which itself extends more upward at the pupillary border ("ectropion").

The shape and nature of this continuity is not suggestive of a tumor developing from the sphincter tissue but has more the character of a malformation. The myomatous tissue, the sphincter tissue, and the tissue of the anterior border layer and nevi are mutually continuous (figs. 6 and 7). The architecture of these "nevi" is different from that of nevi elsewhere and especially of the skin. They are a condensation of cells identical

Fig. 8 (Hagedoorn and Salim). P. A. 1283, section 477, ×180. Tissue of ectropionated sphincter is directly continuous with "nevus" tissue (depigmented specimen). Ectropion of pigment layer.

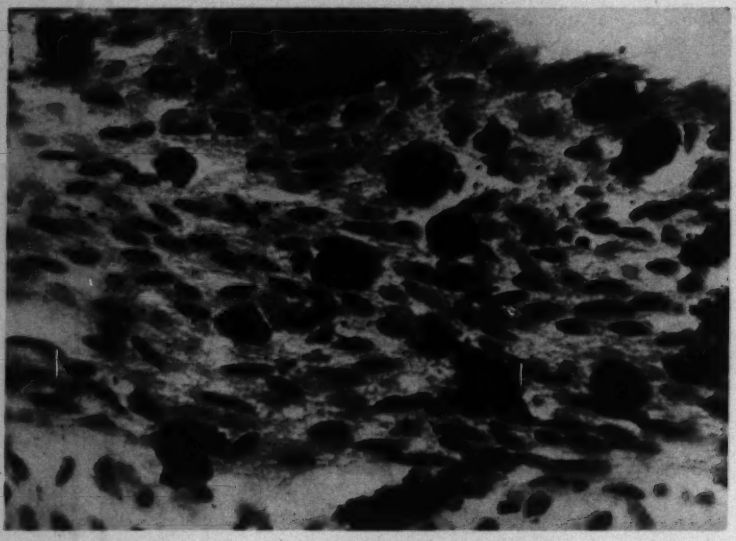

Fig. 9 (Hagedoorn and Salim). P. A. 1283, section 438, ×480. Koganei cells in anomaly.

with normal anterior border layer cells (Fuchs). The continuity of this tissue with the ectodermal muscle and leiomyoma is consistent with the view that it develops from the same matrix: the cells of the optic cup. This conclusion is substantiated by more peripheral depigmented sections (fig. 8). Furthermore the origin of the tissue of this anomaly from cells of the optic cup is substantiated by the finding of Koganei cells in the anomaly (fig. 9), which are also known to develop from the ectodermal cells of the optic cup.

It has been stated previously that there was a well-developed ectropion of the pigment epithelium at the pupillary border. Congenital ectropion of the pigment epithelium has been described together with nevi

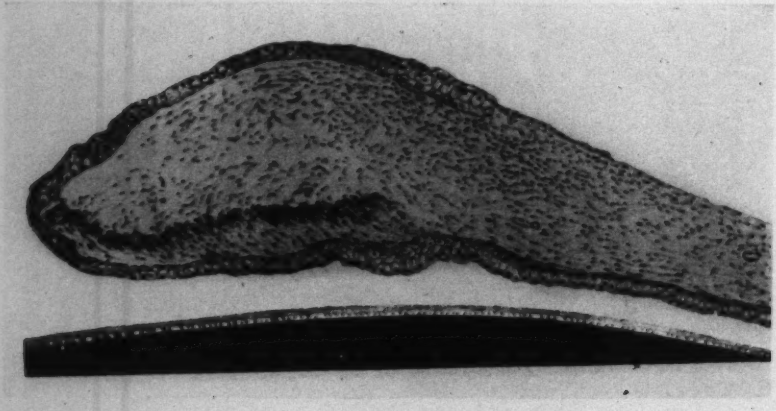

Fig. 10 (Hagedoorn and Salim). According to Samuels. Ectropion of pigment epithelium. Depigmented specimen.

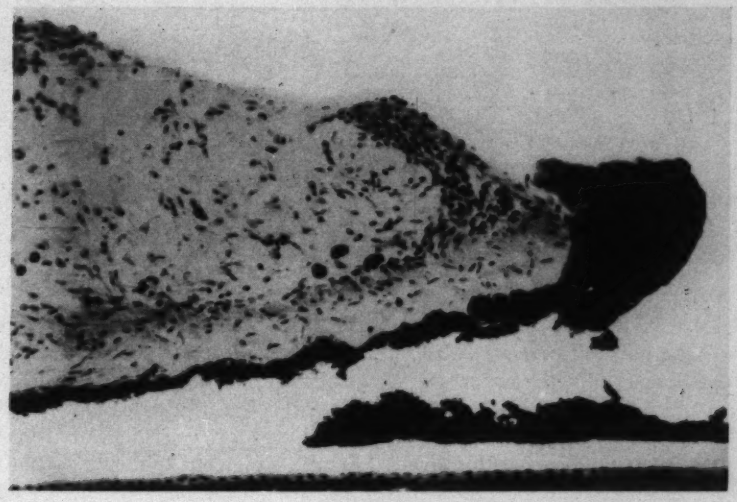

Fig. 11 (Hagedoorn and Salim). P. A. 1283, section 500, ×240. Normal (opposite) area, showing "nevus" continuous with slightly ectropionated sphincter.

of the iris and it is suggested that the ectropion were "caused" by the nevus (Friedenwald[7] p. 419, fig. 3, Plate CLXXXII). In studying the sections, especially the depigmented specimen, the pigment epithelial cells appear rather hypertrophic and not long stretched as might be expected by a "pull" from a nevus (fig. 7, fig. 15). The theory of a primary congenital anomaly, a hypertrophy, is supported by the finding in the literature that a more extensive overgrowth of the pigment epithelium may occur (Sam-

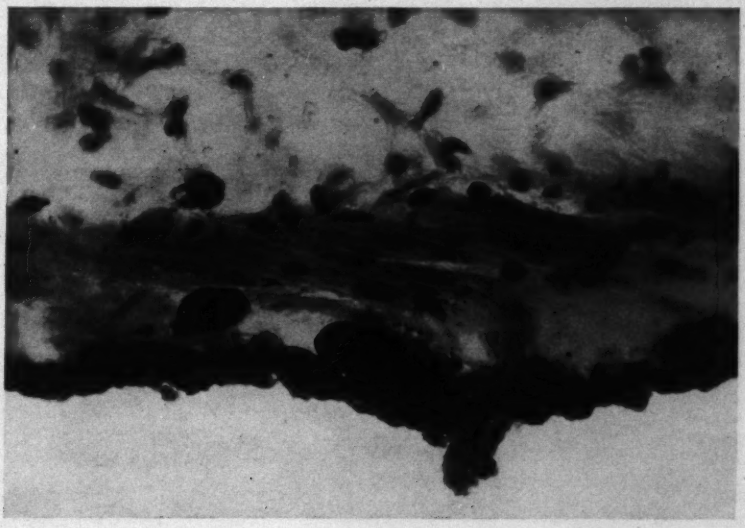

Fig. 12 (Hagedoorn and Salim). P. A. 1283, section 438, ×480. "Normal" area of iris at the opposite "normal" side, showing Koganei cells emerging from the pigment epithelium. Mallory stain.

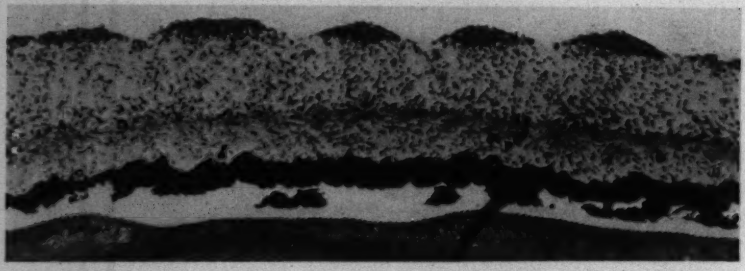

Fig. 13 (Hagedoorn and Salim). P. A. 940, section 240, ×55. Nevi iridis (Fuchs).

uels[8]) (fig. 10). The case presented here may be seen as a similar overgrowth in which the ectodermal cells did not persist as pigment epithelial cells but differentiated into muscle cells, Koganei cells, and anterior border layer cells. It follows that this anomaly has to be considered specific for the iris and the name iridoma seems adequate.

At the opposite side of the pupil in this eye (P.A. 1283) the sphincter, slightly ectropionated (fig. 11), is also continuous with a nevuslike formation, consisting of cells which are neither muscle cells nor the type of cells seen in Fuchs' nevi. It may be stated that there is a (relative) "macromalformation" in the temporal upper quadrant of the iris of this eye, but a "micromalformation" at the opposite side of similar nature.

In this part of the iris the cells of the anomaly were less numerous and did not differentiate into the types seen in the macromalformation. In this part of the iris different stages of emerging of Koganei cells from the pigment epithelium could be traced and even the contact of muscle fibers with the pigment epithelium cells (fig. 12). The eye (P.A. 1283) might be a very unusual malformation. However, further confirmation of the thesis that anterior border layer cells (and nevi) develop from the optic cup epithelium was found in an eye (P.A. 940) which was enucleated for melanoblastoma of the choroid 30 years ago. The patient is still in excellent health. There are many "nevi" on the surface of the iris (fig. 13). The most central condensation of cells is directly continuous with a slightly ectropionated

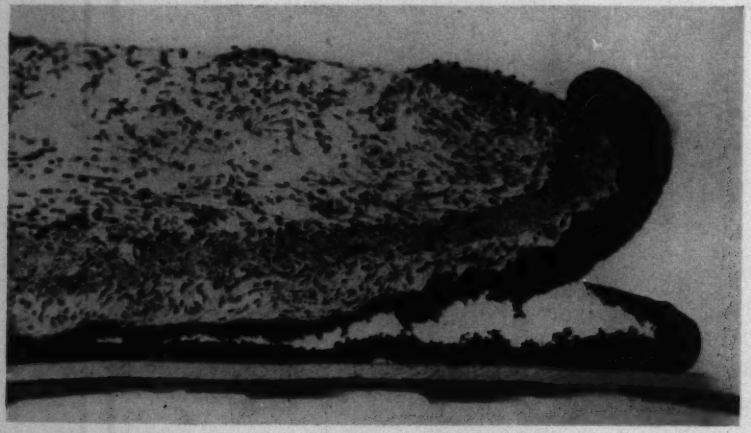

Fig. 14 (Hagedoorn and Salim). P. A. 940, section 370, ×120. "Nevus" continuous with slightly ectropionated sphincter muscle tissue.

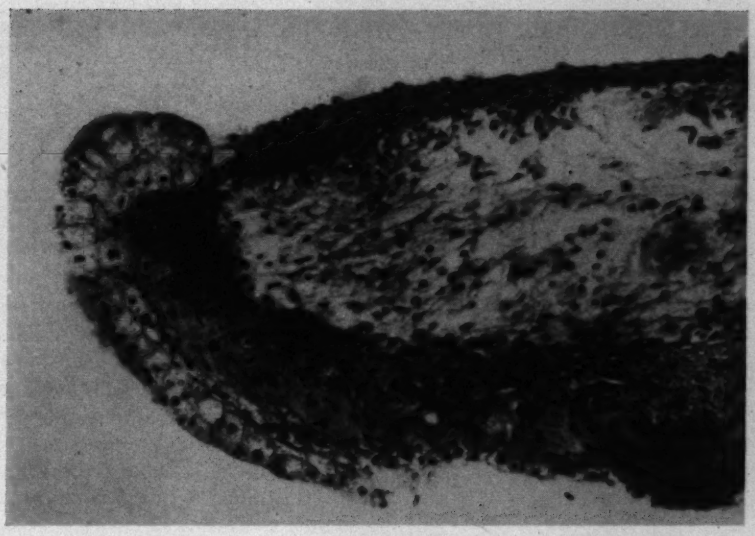

Fig. 15 (Hagedoorn and Salim). P. A. 940, section 345, ×275. Slightly ectropionated sphincter continuous with hypertrophic anterior border layer. Depigmented section.

sphincter muscle (fig. 14), reminding one of the topography in the eye (P.A. 1283) and Friedenwald's case. Again this is especially evident in a depigmented section (fig. 15) where the cell proliferations on the surface of the iris are more arranged in a continuous layer, a hypertrophy of the anterior border layer.

Summary

A tumorlike malformation is described which was directly continuous with the sphincter tissue. The name iridoma was suggested since the anomaly consisted of elements characteristic for the iris: leiomyomatous tissue, Koganei cells and anterior border layer (Fuchs' nevus) cells.

The findings in this anomaly are convincing evidence that the anterior border layer cells and the cells of the nevi irides originate from cells of the optic cup. This view was further substantiated by finding in a second eye the continuation of the tissue of a nevus irides (Fuchs) and a hypertrophic anterior border layer with the normal tissue of the sphincter irides.

Evidently nevus irides with ectropion of the pigment epithelium is due to a malformation of the ectodermal cells of the optic cup.

Wilhelmina-Gasthuis.

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THE INFLUENCE OF MEDIUM COMPOSITION, pH AND TEMPERATURE ON THE TRANSCORNEAL POTENTIAL*

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In a previous publication[1] we described measurement of an electrical potential difference across the surviving beef cornea when anterior and posterior surfaces are bathed in media of identical composition. We noted the similarity of the cornea in this respect to some other biologic membranes. In order to elucidate further the nature of the transcorneal potential and to learn more of its generation, we have studied the effect of temperature, ionic composition and pH of the medium on the magnitude and rate of change of the potential.

METHOD

Details of experimental technique and the apparatus employed in making measurements of the transcorneal potential have been presented in a previous paper.[1] A single addition has been incorporated in the apparatus to permit temperature regulation of the bathing medium in the cells.

Glass tubing, in the form of a continuous spiral, has been inserted into the reservoir above each cell. Water at constant temperature from an external water bath is continuously circulated through the spirals providing heat exchange with the bathing medium. Though glass leaves much to be desired as an efficient material for heat transfer, its low electrical conductivity is a necessity and the present method has proven adequate over the temperature range utilized.

Initial investigations of the transcorneal potential were carried out using Krebs-Ringer bicarbonate solution as the bathing medium. The medium was saturated with a 95-percent oxygen:5.0-percent carbon dioxide mixture, this mixture then being used continuously for aerating and mixing the medium within the cells. As our fundamental concern was with ionic mechanisms related to corneal metabolism it was of importance to work with a medium of as simple a composition as possible. To this end a solution containing only sodium bicarbonate and sodium chloride was tried as a bathing medium. The potential curve obtained with such a medium (adjusted to a pH and molarity equivalent to the Krebs-Ringer solution) was found to be identical to curves obtained previously with the more complex Krebs-Ringer solution. Further investigation showed that 0.154 molar sodium bicarbonate solution alone served equally well as a bathing medium. Substitution of a phosphate buffering system in place of bicarbonate and concomitant use of pure oxygen in place of the 95-percent oxygen:5.0-percent carbon dioxide mixture produced little effect on the potential characteristics.

All the solutions so far employed as bathing medium have been prepared on the basis of a 0.154 molar sodium concentration and the effect of varying ionic strengths on the transcorneal potential has not yet been investigated.

The results to be described are divided into three sections, showing in order, the effect produced on the transcorneal potential by changes in temperature, ionic composition and pH of the medium. Potential recordings obtained from specific experiments are presented to illustrate these effects, but all results reported have been demonstrated a number of times.

* From the Laboratory for Research in Ophthalmology, Western Reserve University and Ophthalmology Service, Department of Surgery, University Hospitals of Cleveland. This work was supported in part by a grant (B-30) from the National Institutes of Health, U. S. Public Health Service. One of us (R. W. Modrell) received additional support from the National Council to Combat Blindness. A preliminary report of this work was presented before the East Central Section of the Association for Research in Ophthalmology, Cleveland, Ohio, January 6, 1958.

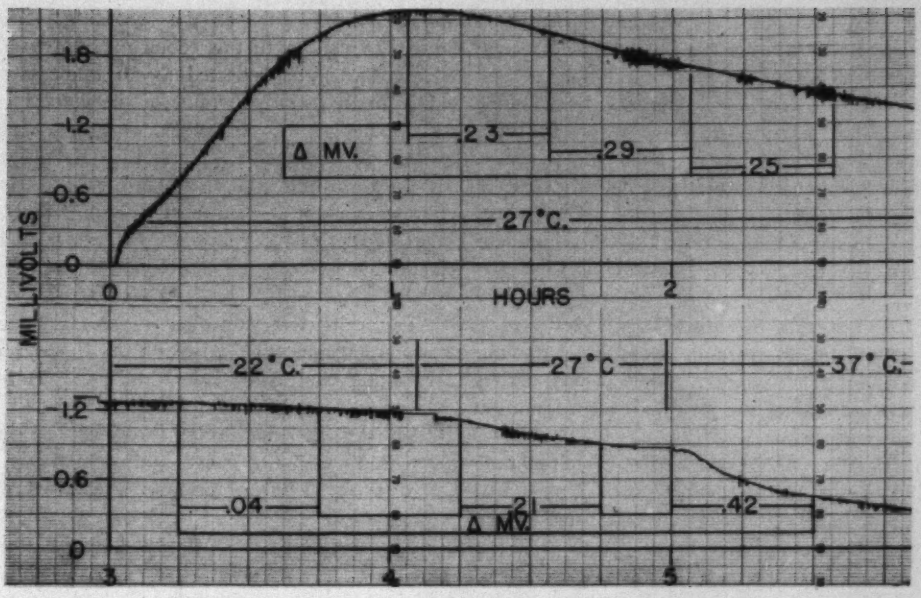

Fig. 1 (Modrell and Potts). The effect of ±10°C. on the transcorneal potential.

Results

A. Temperature

Figures 1 and 2 show the effect of temperature on decay rate of the transcorneal potential. Two types of experiments are illustrated, similar in purpose but varying slightly in the technique employed to secure temperature regulation of the medium.

In both experiments, 0.154 molar sodium bicarbonate solution was used as the bathing medium; 95-percent oxygen: 5.0-percent carbon dioxide mixture as the bubble gas.

An example of the first type is shown in its entirety in Figure 1. An initial medium temperature of 27°C. was maintained for the first three hours of the run. By the end of the first hour, the maximum potential of 2.19 mv. had been attained. In the following two-hour period, the potential decay rate was measured for three successive 30-minute intervals and is indicated on the figure as Δ MV. This rate lies within the range 0.20-0.30 mv. per 30-minute period. The actual differential is not linear with time, however, as is evident from the logarithmic nature

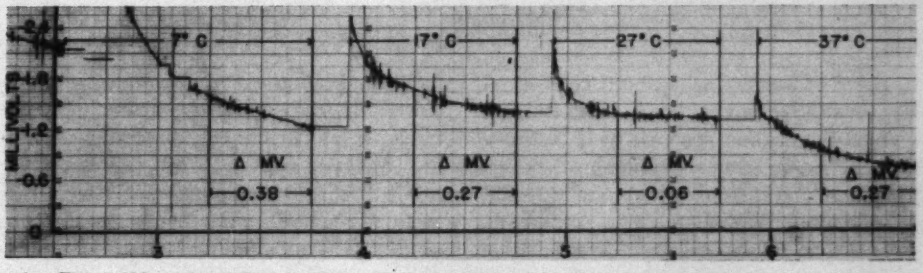

Fig. 2 (Modrell and Potts). The effect of four successive 10°C. temperature increases on the transcorneal potential.

of the curve, and as the time course develops, the decay rate progressively decreases.

At the end of the initial three-hour period, temperature of the circulating water in the glass heat exchangers was lowered to 22°C. and maintained at this level for the next hour. An immediate effect was produced on the decay rate of the potential. During the mid-thirty-minute interval of this hour the potential had decreased by only 0.04 mv.

The circulating water temperature was next raised to the initial 27°C. level with a subsequent increase in decay rate amounting to 0.21 mv. per 30-minute period, closely approximating the original rate found at this temperature.

Finally, temperature of the circulating water was raised to 37°C. producing a further increase in decay rate equal to 0.42 mv. per 30-minute interval.

A second type of temperature experiment, Figure 2, clearly shows the existence of a temperature optimum, necessary for maintenance of the transcorneal potential with minimum decay rate. Only a partial recording of this experiment is shown for sake of brevity.

The time period illustrated extends from 2.5 hours after start of the experiment to seven hours. A maximum potential of 2.9 mv. (not shown) was established one hour after start of the experiment, and the decay phase of the potential was well developed by the end of 2.5 hours. A slight portion of the normal decay curve is visible in the upper left corner of the figure at a level of 2.19 mv.

A temperature of 27°C. was maintained in the cells from start of the experiment until the 2.5-hour point had been reached. At this time the cells were drained and temperature of the medium lowered to 7°C. External circulating water supplying the glass heat exchangers was also brought to this temperature.

The cells were refilled with medium at this lower temperature and recording of the potential continued.

The initial effect on the recording, produced by contact of this cooler medium with the cornea, was reflected as an immediate and greatly increased value of the potential. This change was transient, however, and within 15 minutes the potential had fallen to its pre-existing value. Recording at this temperature was continued for one hour. During the last 30 minutes of this period Δ MV. was measured and found to be 0.38 mv.

The cells were drained a second time, medium temperature adjusted to 17°C. and recording continued. The pattern of events was similar to that noted before but to a lesser degree. The initial transient rise in potential was not as great; and when Δ MV. was measured during the final 30 minutes of recording, it was found to be only 0.27 mv.

The procedure was repeated again, this time with the medium at 27°C. Δ MV. at this temperature was strikingly reduced to 0.06 mv.

At 37°C., the highest temperature employed in this experiment, the decay rate increased to a value of 0.27 mv. per 30-minute period, equal in magnitude to the value found at 17°C.

Unquestionably an optimum temperature for maintenance of the transcorneal potential had been reached and passed through in the vicinity of 27°C. At 10 degrees to either side of this value the decay rate of the potential is greatly increased. This is particularly significant in view of the estimates of corneal temperatures some 7°C.-10°C. lower than body temperature.[2]

B. Ionic environment

An indication of cation selectivity required by the cornea in maintaining the transcorneal potential is illustrated in Figures 3, 4, and 5.

All three types of experiments were carried out at 27°C. Initial medium in the runs of Figure 3 and Figure 4 was 0.154 molar sodium bicarbonate solution saturated with 95 percent oxygen-5.0 percent carbon dioxide

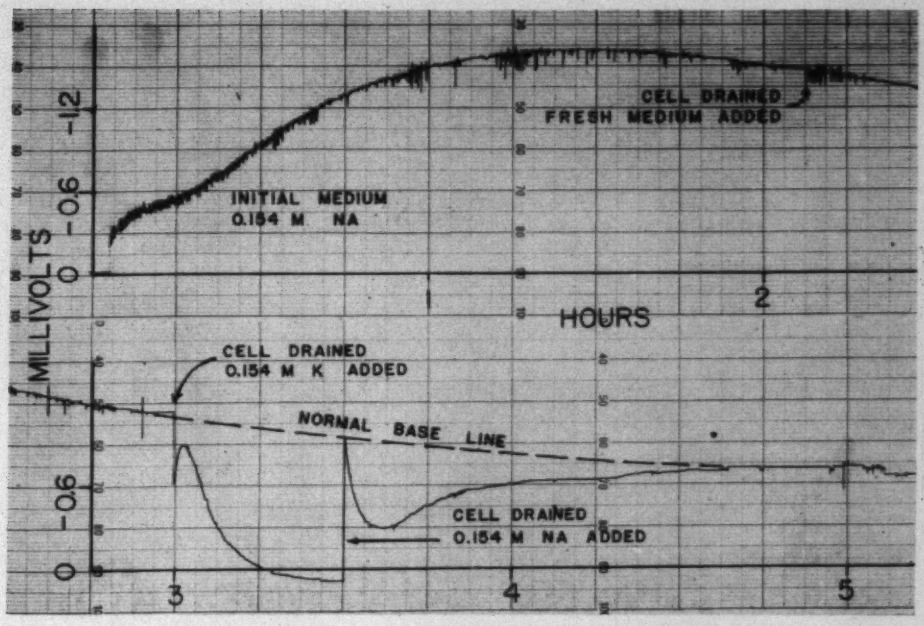

Fig. 3 (Modrell and Potts). The effect of the potassium ion on the transcorneal potential.

mixture. Composition of the medium for the experiment of Figure 5 will be discussed below.

Figure 3 is a record of an entire experiment, a maximum potential of 1.62 mv. being generated after 1.5 hours. In the early part of the decay phase, that is, two hours from start, the cells were drained and fresh medium, identical in composition to the original, was used for refilling. Such a manipulation is shown to produce no effect on the potential even though the moist cornea remained completely free of solution contact for approximately five minutes.

At three hours time, the cells were drained a second time and refilled with

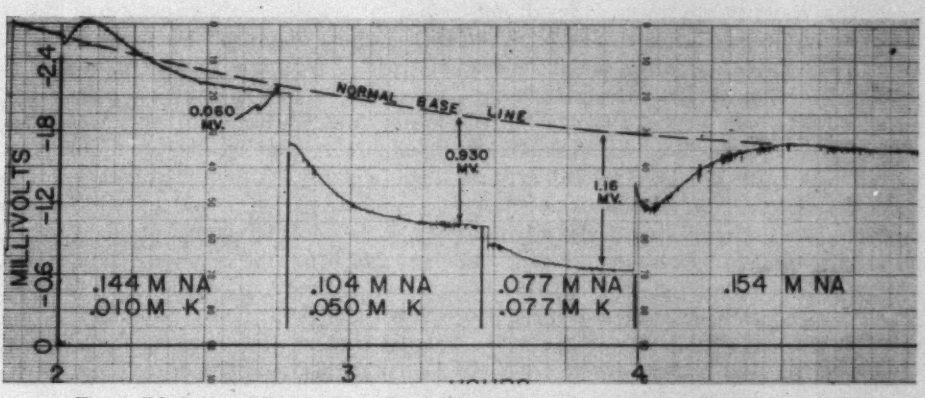

Fig. 4 (Modrell and Potts). The effect of decreasing the sodium-potassium ratio on the transcorneal potential.

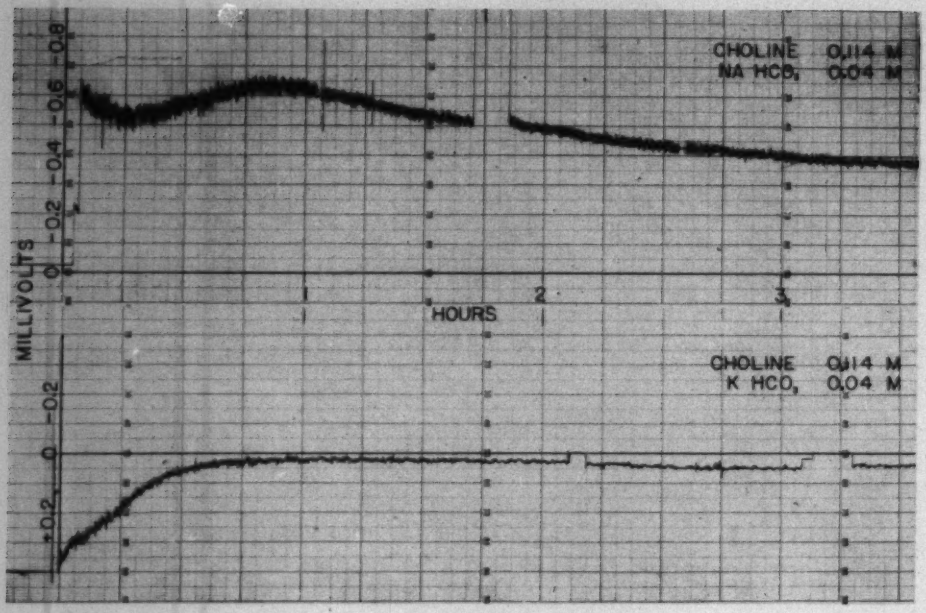

Fig. 5 (Modrell and Potts). The necessity of the sodium ion for maintenance of the transcorneal potential.

medium in which all the sodium had been replaced by potassium ion : 0.154 molar potassium bicarbonate solution. There followed immediately a sharp drop in potential, 0.48 mv. below the normal base line. The potential then increased slightly (0.3 mv.) as though to recover the pre-existing potential level. This trend shortly reversed itself and the potential dropped rapidly to zero.* The over-all effect was that of an initial hyperpolarization followed by a sharply declining phase.

The zero potential level was maintained for an additional 15-minute period in the potassium medium. The cells were then drained again and refilled with the original 0.154 molar sodium bicarbonate solution.

A pattern of events followed, exactly opposite those which had occurred in changing to the pure potassium medium. The potential increased immediately to the normal base line level. There then followed a second drop but this was shortly altered and a final base line potential of 0.75 mv. was gradually attained.

The second experiment of this group is shown in Figure 4 and demonstrates the effect of varying sodium/potassium ratios in a medium of constant ionic strength.† It is a partial recording starting at two hours and ending at five. A maximum potential of 3.0 mv. was reached 1.25 hours from start in a pure sodium bicarbonate medium of 0.154 molarity. A portion of the normal decay phase of the potential is visible here also in the upper left corner of the figure.

At two hours the cells were drained and refilled with medium containing 0.144 molar sodium and 0.010 molar potassium. A hyperpolarization effect immediately developed similar to that described in the previous ex-

* The potential is actually shown to pass through zero and stabilize at a slightly positive value of 0.08 mv. See also Figure 5.

† The bicarbonate salt of these cations was used in preparation of all solutions.

periment. In declining from the hyperpolarized state a new base line potential was established 0.06 mv. below the original level but still exhibiting the same decay rate as existed before addition of the potassium.

The cells were drained a second time (2.75 hours) and refilled with medium containing 0.104 molar sodium and 0.050 molar potassium. A drop in base line potential followed to the extent of 0.93 mv. below the normal base line, however no aberrant polarization effect was evident. Decay rate at this newly established potential level appeared to be the same as would be expected under normal decay conditions.

The cells were drained a third time (3.5 hours) and refilled with medium containing equimolar concentrations of sodium and potassium. The potential was now 1.16 mv. below the normal base line potential and at an absolute value of only 0.63 mv. Again, in this case, no hyperpolarization effect was noted on addition of the new medium.

At four hours the cells were drained for a final time and medium of the original composition added: 0.154 molar sodium bicarbonate solution.

The potential immediately increased to a value of 1.35 mv., a *hypo*polarization developed which gradually shifted to establish a higher potential of 1.78 mv. This value being at the level which the potential would have reached under normal decay conditions.

The last set of experiments in this group, Figure 5, emphasizes the indispensable role of sodium in production of the transcorneal potential, even at low absolute concentration in the medium.

The figure shows two separate experiments. The medium in both of these consisted of a 0.114 molar solution of choline chloride adjusted to pH 7.8 with hydrochloric acid. In the first experiment (upper curve), sodium bicarbonate was added to give a sodium ion concentration of 0.04 molar, while in the second experiment (lower curve), potassium bicarbonate was added in place of the sodium salt.

TABLE 1

pH OF MEDIUM SATURATED WITH FIVE-PERCENT CO_2 TO 95-PERCENT O_2 AT VARIOUS BICARBONATE CONCENTRATIONS

Molar Concentration		pH
NA HCO_3	NA CL	
0.001	0.153	6.0
0.050	0.104	7.6
0.100	0.054	7.9
0.154	—	8.0+

Results of this comparison are evident on examination of the figure. The general form and characteristics of a normal potential curve are seen in the first experiment where sodium is the significant cation present. The magnitude of this potential is considerably reduced as a result of the low sodium concentration.

In the second experiment with potassium as the significant cation, a slight initial positive potential was recorded. This potential shortly declined to a near zero level and so remained for the duration of the experiment.*

C. pH

The experiments so far carried out to investigate pH effect have consisted of a series of medium substitutions, similar to those used in the potassium experiments, but in which the bicarbonate concentration has been varied to obtain different pH levels, buffered with the 95-percent oxygen:5.0-percent carbon dioxide mixture.

The pH range studied extended from 6.0 to 8.0. Osmolar concentration of the medium was maintained constant at each pH level by varying the ratio between sodium bicarbonate and sodium chloride. Table 1 indicates the respective concentration of each salt required to achieve a specific pH value with a constant medium concentration of 0.154 molar.

To check the effect of each of these solutions, a run was started with the pure so-

* See footnote page 838.

dium bicarbonate medium in the cells. Two hours from start of the experiment, after maximum potential had been reached and the decay phase started, the cells were drained and refilled with the medium containing bicarbonate at the next lower concentration (0.100 molar) and consequently at a lower pH level (pH 7.9).

The potential, measured immediately after changing medium, showed a slight transient rise in value, returning to the pre-existing potential level within a 10-minute period. No permanent change in decay rate, or potential level, was thus produced.

The same procedure was followed for the remaining two solutions at pH 7.6 and 6.0 with essentially the same results.

Discussion

The most significant information to be obtained from the present series of experiments resides in a comparison of the effect produced on the transcorneal potential by suboptimum conditions of temperature and ionic environment.

In the case of temperature, a variation to either side of optimum markedly affects the *rate of decay* of the potential from its previously established value and directly implies a primary biologic mechanism. It would be difficult to imagine a purely physical diffusion process where ionic mobility passes through a maximum with temperature (unless one invoked complex formation for which there is no evidence or any established analogy).

Though a detailed, quantitative study of this temperature-rate relationship has not yet been completed, it may be noted that continuous recordings of the transmembrane potential exhibit a form characteristic of certain other rate processes showing temperature involvement of an exponential and determining nature. It is expected that further work in this direction will result in a more explicit interpretation of the energy requirements associated with corneal metabolism and ion transfer.

The presence of a second cation, in an otherwise pure sodium medium, produces an effect on the transcorneal potential fundamentally different from that brought about by variations in temperature of the medium.

If, in a bathing medium of constant ionic strength and single anion composition, part of the sodium present is replaced by potassium, there immediately follows a reduction in absolute level of the potential, the magnitude of such reduction is a function of the ratio of the two cations and is readily measurable when as little as six percent $\left(\frac{0.01\ M\ K^+}{0.144\ M\ Na^+}\right)$ of the total cation present is potassium. In a medium with only potassium serving as cation not only is the negative potential abolished but there is a slight swing to the positive side.

In other experiments where the normal transcorneal potential has been developed in a pure sodium medium, replacement of the sodium by choline results in a decrease in the potential level much the same as described in the experiments involving potassium substitution, that is, Figure 4. A notable difference occurs, however, in reversibility of the two types of substitution. When the potential has been reduced to zero (or slightly positive) by use of a pure potassium medium, a normal base line potential can be re-established by placing the tissue back in a sodium medium. When choline has been employed as replacement for sodium, and a zero potential level attained in the pure choline medium, changing the tissue back to a sodium medium *does not* result in regeneration of the potential.

The initial presence of sodium is obviously essential for generation and maintenance of the transcorneal potential of normal polarity while potassium or choline in sufficient concentrations appear to prevent this occurrence. No negative potential is observable where all Na^+ is replaced by choline.

This unequivocal requirement of the mechanism for sodium suggests a specific

biologic mechanism rather than a nonspecific physical process, for example, ion exchange, as a likely explanation for the transcorneal potential.

We are aware of the report of Holt and Cogan[3] on the unusual (10×) increase in A.C. impedance caused by K^+ in the solution bathing the cornea. One cannot be certain that there is a direct connection between the phenomenon observed by us and the impedance increase, for a change in capacitative reactance in either direction from the optimum could cause this phenomenon. Independent measurement of D.C. resistance (which is difficult) might contribute more to our knowledge of K^+ action. Since any of the changes of potential herein reported by us could conceivably be the result of a resistance change alone, D.C. resistance measurements together with measurements of a maximum or "short circuit" current will be a necessity for further interpretation of our results.

Equally curious is the observation by Ussing[4] that K^+ is necessary for maximum transport of Na^+ although not actively transported itself. If one assumes the transcorneal potential to be indicative of a transport process, we have no evidence of such a potassium requirement. However, since the required amount found by Ussing is quite low, it is conceivable that there is enough K^+ originally present in the cornea to supply the need.

Summary

The effect of pH, temperature and medium composition on the transcorneal potential has been studied. Though the effect of pH appears to be a minor one, changes in temperature and medium composition produce well-marked and characteristic biological responses. A temperature between 22°C. and 27°C. has been found optimum for maintenance of the transcorneal potential and values to either side of this range produce a marked increase in decay rate of the potential.

Potassium ion lowers the absolute level of the potential without affecting the decay rate and in experiments where only potassium is present in the medium as the active cation, a slight reversal in polarity of the potential has been observed.

This potassium effect has been discussed in relation to other data appearing in the literature regarding the action of potassium on membrane phenomena.

2065 Adelbert Road (6).

Appended note

Since this work was first reported we have investigated the suggestion made by Dr. David Maurice that sclera might have high conductivity relative to cornea, and that the exposure of sclera around oval cornea in our circular holder might represent a potential short circuit. Investigation has proved this to be true since the 1,000-cycle impedance ratio of cornea to stroma is approximately 3.5 to 1.0. This results in a lowering of the absolute value of the transcorneal potential, but since the conclusions presented above are based on potential changes and on relative values, they are not invalidated by this finding.

The question of the absolute value of the potential difference across the surviving beef cornea is open to some interpretation. In our laboratory using a glass pipette micro electrode and penetrating corneal epithelium, we have measured values as high as 40 mv. but this represents intracellular-extracellular difference.[5] Donn[6] who worked in collaboration with Maurice reported values of this magnitude for the surviving rabbit cornea, but found the potentials very labile to any manipulation. When we have used cotton-wick electrodes on corneas in rabbits under Nembutal anesthesia, on excised beef eyes, or on surviving beef corneas, we have measured values of 22 to 25 mv. but have never attained the values of Donn. When we have held beef corneas in a holder originally designed for human eyes (so that no sclera is exposed), we have measured potentials as high as 6.0 mv. However, here we have damaged the limiting membranes by the clamp so the values obtained are open to question. We can say with certainty that the transcorneal potential of the beef eye is at least 6.0 mv. and probably as high as 25 mv.

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Ophthalmic Miniature

I will now place in concise juxtaposition the chief reasons which induce me to regard interstitial keratitis as a direct result of inherited syphilis.

1st—From its being a very well-marked and peculiar form of disease, it is *à priori* probably that it acknowledges some single and definite cause.

2nd—Its subjects are almost invariably of very peculiar physiognomy, and usually bear the most marked similarity to one another.

3rd—Its subjects almost invariably have their upper central incisor-teeth of the permanent set dwarfed and notched in a peculiar and characteristic manner.

4th—In most cases the features alluded to under the last two heads bear no resemblance whatever to those of "struma" properly so called. The subjects of true struma, on the contrary, usually have large white teeth, and are often of florid complexions.

5th—I have not yet seen a single case in which the patient was the subject of phthisis, and very few in which enlargement of the glands of the neck had occurred.

6th—It affects by preference the eldest living child of the family, a circumstance to be expected under the syphilitic hypothesis, but wholly inexplicable under that of struma. . . .

Mr. Jonathan Hutchinson,

Royal London Ophthalmic Hospital Reports, **2**:102, 1859-1860.

NOTES, CASES, INSTRUMENTS

DIAGNOSIS OF DIABETES BY THE OPHTHALMOLOGIST

ROBERT H. BEDROSSIAN, M.D.
Vancouver, Washington

The diagnosis of diabetes by an ophthalmologist in an otherwise unsuspecting patient usually impresses both the patient and the physician to whom the patient is referred for care. Such a diagnosis is most commonly made on the basis of the ophthalmoscopic examination and presents no problem since fasting blood sugars are elevated and glycosuria is present. Less certain is the diagnosis of diabetes in patients who complain primarily of fluctuating vision and have no pathologic condition of the fundus.

The ophthalmologist must show a high degree of suspicion in examining such patients.[1] Unless he is certain of what he wants in the way of laboratory help, the diagnosis of early diabetes may be missed. To be satisfied with negative urine sugars or a fasting blood sugar is to give a false sense of security to many an early diabetic. A normal fasting blood sugar and sugar-free urine do not rule out diabetes.[2]

In a period of less than seven months, I have had the opportunity to examine 10 such patients. Five of these cases are briefly described to show the pattern of all. They illustrate the value of various tests for the diagnosis of diabetes and why the ophthalmologist should not transfer the burden of proof to someone else who may not make adequate studies.

CASE REPORTS

CASE 1

Mr. G. S., aged 72 years, had four changes of glasses over two years by two different ophthalmologists. Glycosuria was found once on routine physical examination. A two-hour postprandial blood sugar was 114 mg. The patient was refracted and a change in refraction found. The fundus examination was normal for his age. After three months the refraction again changed and a glucose tolerance test was ordered. The blood sugar rose up to 240 mg. percent in one hour. Diagnosis: Mild diabetes.

CASE 2

Mrs. W. R., aged 59 years, had new glasses prescribed by an optometrist three months prior to the following episode. A routine physical examination was essentially normal except for slight overweight. The urinalysis was normal. The patient was placed on a diet and a drug containing thyroid to help weight reduction. Sudden blurring of vision was noted after taking the medication for 24 hours. She was referred to me by her family physician. Her hyperopia was 1.5 diopter more than her present correction. The vision improved from 20/70 to 20/20 in each eye. The fundus and muscle balance were normal. A fasting blood sugar was 200 mg. three days after stopping of all medication. On a glucose tolerance test, the sugar went up to 333 mg. percent. Diagnosis: Early diabetes. The appetite depressent drug with thyroid probably helped decrease blood sugar and the refraction changed.

CASE 3

Mrs. M. E., aged 53 years, had two changes of glasses in a 10-month period and double vision for one month. She was hospitalized because of dizziness and ecchymosis of the left eye after falling down. The eyegrounds showed Grade I arteriosclerosis. The fasting blood sugar was 134, ad the two-hour nonfasting sugar was 114. On a glucose tolerance test the sugar went up to 304 mg. percent. Diagnosis: Early diabetes; probably associated mild superior rectus palsy.

CASE 4

Mr. O. S., aged 73 years, had a resection of the jaw because of a malignancy. He was not happy with his glasses which had been prescribed four months earlier. A urinalysis while in hospital for the jaw resection was reported as normal. A 2.5-hour postprandial blood sugar was 140. The fasting blood sugar was 105 and the one-hour level 252 mg. percent on a glucose tolerance test. Diagnosis: Early diabetes.

CASE 5

Mr. H. B., aged 78 years, had fluctuating vision. His fundus was normal. A change in refraction was found. The postprandial blood sugar was 160. The patient was referred to his family doctor for further diagnostic studies. He had four urine specimens checked for sugar and all were negative. The patient was told he did not have diabetes and he was not interested in further diagnostic studies. Diagnosis: Probably diabetes.

DISCUSSION

Internists are relying less and less on fasting blood sugars and urinalysis to rule out diabetes.[3,4] Many are advocating the use of the postprandial blood sugar as the single

most diagnostic test.[3,5] This test is of little value, however, unless a definite amount of food is given the patient and he has the blood drawn within 1.5 to 2.0 hours after eating. It is not enough to tell the patient to eat some breakfast and then have the blood drawn. Cases 1 and 3 illustrated this point.

A suggested breakfast or meal prior to the test contains 62 gm. carbohydrate, 19 gm. protein, and 25 gm. fat.[3] This might be: one cup of milk (whole), one cup of orange juice, two slices of toast, one egg, and two teaspoons butter.

A two-hour level above 150 mg. percent is definitely high. Levels between 110 and 150 mg. percent are borderline.[3] They should be followed by a glucose tolerance test. Starvation, dehydration, and other debilitating diseases may alter a patient's response to the ingestion of glucose but this is unlikely to be a factor in an ophthalmologist's practice.

410 West 26th Street.

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ORTHOPTIC SURGERY*

For the treatment of amblyopia ex anopsia

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Chicago, Illinois

Berke[1] recently analyzed the after-results of 256 cases that he had operated for concomitant convergent squint. In this series he obtained single binocular vision with good stereopsis in 60 or 23 percent. He concluded that such a functional result depended on the elimination of amblyopia ex anopsia and a full surgical correction of the squint relatively soon after its appearance. The prognosis was poor when the patient was six years of age or older unless the deviation was intermittent. No functional result ever occurred in any of the following situations: when a constant squint began at birth; when the amblyopia before operation could not be improved to 20/40; and when a residual squint of over 10 prism diopters persisted after surgery. Costenbader, in the discussion, qualified the statement that no case of congenital strabismus can obtain a functional cure, as his records demonstrated that three percent of 330 such cases had developed stereopsis.

According to Jampolsky,[2] properly designed surgery in strabismus may favorably influence both the motor and sensory mechanisms of fusion. He stresses that in exotropia surgical overcorrection is desirable as the diplopia that results tends to awaken a dormant normal correspondence fusion.

Anderson,[3] Goldman[4] and Kestenbaum[5] have noted that in congenital eccentric nystagmus the nystagmus is frequently less or absent on gazing to the right or left. Assuming that the nystagmus is minimum if the patient turns his eyes five mm. to the left, both eyes are then surgically rotated five mm. to the right by five mm. recessions and resections of the four horizontal muscles. A steadier position of the eyes results with a consequent improvement of vision.

The standard procedure in the treatment of a child with esotropia who has amblyopia in the squinting eye is to operate on the amblyopic eye. Thompson[6] abandoned this

*From the Department of Ophthalmology, Northwestern University Medical School. Read before the Chicago Ophthalmological Society, March 16, 1959.

method when he found that he obtained better results by operating on the dominant eye. He considered that the occlusion of the dominant eye by the bandage and the subsequent discomfort of the operated eye promoted the effective use of the amblyopic eye and thus favored a functional result.

The status quo of the fusion sense probably receives a greater shock when the dominant eye is operated and this jolt favors a balanced functional realignment of the eyes. A more drastic manipulation of the dominating eye in the following case was followed by a remarkably favorable end-result.

Case report

The boy, whose operation is discussed, was first seen in May, 1952, at the age of two years three months. The parents had noted that the right eye turned in three months previously. Examination disclosed a convergence of the right eye for distance and near of 70 prism diopters. As the cycloplegic examination did not reveal a significant error of refraction, occlusion of the left eye for two weeks followed by occlusion of the right eye for one week was advised. Elastoplast occluders were thus used for one year.

At the age of four years, after no oclusion for nine months, the unaided acuity was: R.E., 20/100; L.E., 20/20. The refraction under atropine cycloplegia was: R.E., +1.25D. sph. ⌒ +1.5D. cyl. ax. 120°, 20/70; L.E., +1.25D. sph. ⌒ +0.5D. cyl. ax. 60°, 20/20. A Lindner occluder over the left lens for two months improved the vision of the right eye to 20/40+, but the acuity of the right eye rapidly deteriorated to 20/70 after the occluder was removed.

In order to improve more durably the vision of the right eye an operation was proposed to change the right convergent squint temporarily to a left convergent squint with the idea of later straightening the eyes after the right amblyopia was permanently improved. On July 20, 1954, the following procedures were done: recession of the right medial rectus four mm., resection of the right lateral rectus six mm., and *recession* of the left lateral rectus five mm. The anticipated result followed.

After the operation the right eye fixed and the left eye turned in 35 prism diopters. Three months later, the corrected acuity of the right eye was 20/20— and the squint was alternating. In May, 1955, the corrected acuity was 20/20 in each eye and the eyes were parallel. In June, 1956, two years after the operation, the child acquired an epidemic keratoconjunctivitis in the right eye. To my surprise the right eye now turned in and the corrected acuity was again: R.E., 20/70; L.E., 20/20. In March 1957, at the age of seven years, the eyes were again straight. The corrected acuity was 10/13 in each eye and he had binocular stereoscopic vision, demonstrable by the Wirt test, which he has maintained since.*

Discussion

A functional result was favored in this case by the late age of onset, two years; the relatively young age at operation, four years; and an attainable vision of 20/40+ preoperatively in the right amblyopic eye. That shifting the fixation to the right eye improved the acuity of this previously amblyopic eye to normal was anticipated. But that this procedure would overcome a postoperative deviation of 35 prism diopters and finally eventuate into an excellent functional result without further intervention was entirely unexpected. Also unforeseen was the long period required for the oculomotor balance to be finally stabilized—over five years. Had the residual postoperative deviation been closer to parallelism, stabilization undoubtedly would have occurred much earlier. Perhaps the fixing left eye could have been sufficiently handicapped by a lesser recession of its lateral rectus—three mm. instead of the five mm. done.

The operation seems worthy of report if only because it dramatizes the importance of the sensory aspect of concomitant strabismus so convincingly. In similar cases, operation on the dominant eye, as advised by Thompson, may accomplish the same outcome. I have extended Thompson's method to selected cases of exotropia and have been favorably impressed by the more definitive results thus obtained.

4010 West Madison Street (24).

* When seen recently at the age of nine years (five years after operation) the original left dominance had returned. The indicated correction had changed to: R.E., +2.0D. sph. ⌒ +1.0D. cyl. ax. 120°, 20/15; L.E., +1.25D. sph. ⌒ +0.5D. cyl. ax. 60°, 20/15+.

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STAPHYLOCOCCUS SENSITIVITY IN CHORIORETINITIS

Report of two cases

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East Orange, New Jersey

In 1895, Osler, in describing tetanus,[1] stated that the toxin "is perhaps the most virulent poison known." Present-day toxin studies show that this statement is still valid. Osler further stated that "every feature of the disease can be produced experimentally without the presence of bacilla." This concept is also valid today. Bryan,[2] in 1956, divides tetanus toxin into two fractions, tetanospasmin and tetanolysin. Tetanospasmin is the "most potent poison known" to affect nerve tissue. The same toxic factors are essentially present in the staphylococcus toxin. The toxin produced by the staphylococcus is lethal. It can cause death and is capable of digesting human blood fibrin.[2]

The following two cases illustrate the allergic inflammatory response of the eye to the staphylococcus toxin.

Case reports

Case 1

A 16-year-old girl complained of poor vision in the left eye for two months. Eye examination had been delayed because the patient felt that glasses would be required. Ophthalmoscopically, the eyegrounds showed a cloudy vitreous with edema of retina. The lesion affected the papillomacular fibers just lateral to the disc so that a central scotoma was present. The findings are characteristic of chorioretinitis juxtopapillaris. Subjectively, the patient was only able to see the periphery of a person or object, the central portion was "blacked out."

The patient was hospitalized. The only positive physical finding was pustules on the face. Chest X-ray films and laboratory tests included Vollmer patch test, serology, urea nitrogen, blood sugar, total protein, and urinalysis. Significant laboratory findings showed a high white blood count, 15,000 to 17,000 although afebrile, and secondary anemia with many immature RBC in the smear. The blood culture was negative. The positive findings were confirmed upon repeated tests. The total protein was 5.8 mg. percent.

Therapy consisted of ACTH with supplementary vitamins B and C, and calcium gluconate intravenously daily. The ocular inflammation subsided on the fifth day. At the same time the facial pustules cleared. The ACTH was gradually reduced over the succeeding five days. At the end of 10 days, the patient was discharged with the eye and the face clear and the vision improved to 20/30. Although the visual field showed a centrocecal scotoma at the time of discharge, subjectively the patient reported a marked reduction of the scotoma.

Intradermal skin tests gave a strongly positive reaction. Test material consisted of a staphylococcus toxoid (100 skin necrotizing doses) diluted to 1:1,000. The test reproduced the facial pustules with a mild exacerbation of the chorioretinitis. Intradermal test of streptococcus toxoid and the control test of the diluent were negative.

Treatment consisted of desensitization with the diluted staphylococcus toxin (1:10,000) biweekly. After 10 weeks, the vision improved to 20/25, the centrocecal scotoma was minimal. Only scattered relative scotoma were present for several degrees along the horizontal meridian. The patient was asymptomatic, the face clear of pustules, and the eye quiet.

Case 2

A 65-year-old man complained of sudden onset of blurred vision in both eyes. The patient was under medical treatment for chronic simple glaucoma of both eyes for approximately two years. The glaucoma was controlled by miotics. Examination of the tension was normal but the vitreous of both eyes was hazy, characteristic of posterior uveitis of both eyes.

The patient was hospitalized. Physical findings were negative except for one-plus ankle edema, uveitis, and periorbital edema. The history revealed a severe infection of both lower legs over the tibia approximately six weeks previously which was treated with intramuscular penicillin by his local physician.

Laboratory tests showed low total protein (5.0 mg. percent), high white blood count (15,000-18,000), and many immature RBC. The blood cul-

ture and serology were negative. Repetition of the blood count confirmed the high white count although the patient was afebrile. The blood urea, nitrogen, and sugar were within normal limits. The Vollmer patch test was negative.

Treatment consisted of ACTH (80 u. intramuscularly) and supportive therapy of liver, vitamins, and diet. After five days a spontaneous diuresis cleared the periorbital and dependent edema. The vitreous also cleared. The media and retina were free of opacities and edema. No mercurials or carbonic anhydrase inhibitors were given.

When the patient was discharged after 11 days, the vision was normal, periorbital and dependent edema absent.

Intradermal staphylococcus toxoid test of diluted (100 skin necrotizing doses) 1:1,000 produced a strongly positive reaction, a control test of normal saline was negative. The streptococcus-diluted toxoid produced only a mild positive reaction.

The treatment consisted of desensitization using staphylococcus toxoid diluted 1:5,000 for eight weeks. The patient has been asymptomatic for over one year. The glaucoma is well controlled. No increase in the dosage of miotics was required during therapy.

Conclusion

Present medical observations confirm Osler's careful studies in 1895, on the poisonous effect of toxins. Both cases showed evidence of staphylococcus toxoid sensitivity. The toxin was capable of reproducing the disease. The blood counts showed leukocytosis, anemia, many immature RBC, and low protein. No fever was present, contrary to expectation in the presence of a marked leukocytosis. It is well established that the staphylococcus is hemolytic organism and that it produces a lethal toxin. The clinical evidence strongly suggests that the toxin is responsible for the inflammatory response, leukocytosis, anemia, and hypoproteinemia. Perhaps this is the product that Menkin called leukotaxin, the leukocyte-promoting factor.

It is also important to note that the blood count, inflammatory response, and so forth became normal without the use of antibiotics. This suggests the possible etiology of staphylococcus infections which may be due not to the staphlyococcus itself but to its toxins. It may be that antibiotics effectively destroy the organism but not the liberated toxins which are definitely capable of producing the disease. Steroids reversed the disease, and its sequelae. Recurrence of the disease process was prevented by desensitization.

719 Park Avenue.

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OCCLUSOR FOR VISION SCREENING OF SCHOOL CHILDREN

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Palo Alto, California

With the new trend toward initiating systematic vision screening in kindergarten, it has become imperative to develop safe and efficient methods of screening. The device described here was conceived with the idea of making vision screening at an early age as fool-proof as possible. In particular the peeking around the edges of commonly used occlusors such as cards or paper cups held by the child himself should be eliminated. If this is not done, we are prone to miss unilateral amblyopias.

In vision screening of school children we are primarily concerned with the detection of amblyopia because this is the only condition which requires immediate attention. Refractive errors will usually cause symptoms (asthenopia, blurring of vision) if they are of a degree that requires correction. If they are symptomless, they are, as a rule, insignificant and can be corrected at a later date. Congenital anomalies that are picked up by routine vision screening usually are not amenable to treatment. Congenital cataracts may be an exception.

The younger the child, the more important

Fig. 1 (Bock). Occlusor for vision screening of school children.

is the detection of amblyopia because the chance of cure of the condition decreases rapidly with advancing age. Unfortunately, however, the younger the child, the more difficult it is to test his vision reliably.

The new occlusor consists of a mask-like spectacle frame molded in one piece of white plastic (fig. 1). The front plate has a horizontally oval aperture (6.0 by 8.0 mm.) through which vision is tested. This relatively large size will not produce pinhole effect, a factor unimportant in amblyopia in any case. The center of the peep holes is 52 mm. apart which corresponds to an average pupillary distance in a child between the ages of five to 10 years. In looking through this aperture at the Snellen or "E" chart the child has to hold his head straight. Any tilting or turning will indicate that he is trying to peek. With the shape and fit of the occlusor this is completely impossible, however. A black moustachelike movable arm is mounted on the front plate in such fashion that, as it is flipped up and down, one peep hole opens while the other is securely occluded. The open hole can be recognized by the examiner from afar by the oblique position of the flipper arm. The frame will fit any child from five to 12 years of age.

A total of 5,866 elementary school children in the Sunnyvale school district area were tested with this device by six school nurses* during the school year 1957-58. Twenty cases of amblyopia were found, five of which (or 25 percent) had been missed on previous school screening by conventional methods. During the school year of 1958-59, 4,175 grade school children were examined with these occlusors by seven Palo Alto district school nurses. In kindergarten alone six amblyopias were found, and in the first grade three previously missed amblyopias were detected.

All the nurses reported that they not only felt more confident about the result of their screening but also found this method definitely less time-consuming. They made it more interesting to the children by designating one child as the so-called "flipper" whose job it was to flip the plate up and down as one eye after another was tested. The nurse herself stands near the Snellen or "E" chart pointing to the test lines. Two pairs of spectacles are used. While one child is tested, the next one puts the mask on. This speeds up the procedure greatly. We did not feel that there was any danger of transmitting a contagious disease, since children with obviously infected eyes were excluded from the testing. The occlusor frame is washable with soap and water.

Summary

A new fool-proof occlusor device for vision screening of school children is described. It was found particularly useful in smaller children from kindergarten and up, where it allows more reliable and more rapid screening. By using this device, 25 percent more amblyopias were detected than by the conventional methods.

145 North California Avenue.

* My thanks go to the school nurses of the Sunnyvale and Palo Alto School District who used the new occlusors in their routine vision screening, and to the Peninsula Optical Company who helped in the development of the occlusors. (Patent pending.)

A NEW METHOD*

FOR FIXING DIAGNOSTIC CONTACT LENSES

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When fitting a diagnostic contact lens to the eye, annoying air bubbles between the glass and the cornea are not uncommon. Any glass, in order to be concentric with the corneal circumference, must be held by hand and the patient should not make unexpected movements, lest air be sucked in, obstructing the clear view. These disadvantages, however small, unite to make the use of a contact lens a somewhat cumbersome procedure.

In this article I have described a modification in the use of contact lenses that seems to solve the difficulties and provides additional advantages. The method consists essentially in attaching the lens semipermanently to the eye by means of low vacuum.

CONSTRUCTION

The space between the cornea and the lens has been made accessible by drilling a small hole in the lens, near the haptic part. Over a steel capillary, jutting out from the hole, a polythene cannula of about 10 cm. in length has been fitted. The cannula ends in an ordinary needle cone. To this cone either a syringe for washing away air bubbles or a suction cap providing low vacuum can be attached (fig. 1).

APPLICATION

The glass is simply put on the anesthetised eye, disregarding air bubbles. Next all air is driven out by means of a syringe filled with saline (the rubber cap may also serve for this purpose). The syringe is exchanged for the rubber suction cap, slight pressure on which and subsequent release of which provides a vacuum amply sufficient to turn the glass into a firm suction instrument and to create a rigid connection between the eye and the glass. The glass will automatically assume a position concentric with the limbal ring. In this central position the space between the glass and the cornea is minimal and any decentration would create a larger vacuum. The rubber suction cap is attached to the forehead (with adhesive tape) but may also be hooked over the ear. This will take almost all weight off the glass.

Fig. 1 (Worst). Diagnostic contact lens in position. (Electroretinography lens.)

The system gave perfect attachment to a gonioscopy lens (Goldmann type). The vacuum attachment does not impede rotation of the lens at all. Especially when the chamber angle is to be observed for a prolonged period, or by more than one observer at a time, the firm and yet atraumatically fixed position is of great value. Simplification of goniophotography is another application.

With contact lenses that do not need rotation during examination the system finds full application. I have successfully attached it to fundus contact lenses, electroretinography lenses, mirror gonioscopy lenses and spherical goniolenses and roentgen reference contact lenses. The latter contact lens deserves special interest and will be described in another article.

I expect more applications to arise from the fact that by means of low vacuum even relatively bulky contact lenses can be semi-

* From the University Eye Clinic.

permanently attached to the eye. I envision the fabrication of Barkan gonioscopy and goniotomy lenses on the same principle. It may be of great use to have the goniotomy lens fixed to the eye when performing the operation.

Another suggestion is to fix a small mirror or a minute lamp to the glass. If in this way light is directed outward, it will serve as an indicator for the smallest eye movements. If directed inward, one might be able to illuminate a certain local and very fixed part of the retina. There should be an electroretinographic use for this set-up.

A contact lens with a plane mirror on the nasal aspect will allow indirect transillumination ophthalmoscopy for retinal detachment, from the temporal side, when the nasal approach is unfavorable because of a high nose bridge or a deep-set eye (suggestion of Prof. Dr. H. M. Dekking).

With a suction contact lens which has an optically neutral cornea, it should be possible to photograph fundi of eyes otherwise too unsteady for proper focusing. Correction of strong astigmatism for these photographic purposes seems another application.

As the glass will hold the eye against the opposing forces of the extraocular muscles, certain applications in muscle physiology and pathology present themselves.

van Starkenborghstraat 10.

The photograph was made by the University photography department. I am indebted to K. Otter for his invaluable technical assistance. All of the low-vacuum contact lenses are manufactured by Medical Workshop, van Imhoffstraat 3, Groningen.

Ophthalmic Miniature

We owe to Dr. Giraud-Teulon, and following him, Mr. J. Z. Lawrence, our thanks for the invention of the binocular ophthalmoscope, by means of which we are enabled to save a great deal of time and uncertainty in determining the position of extravasations, exudations, deposits, etc., in the vitreous humor, retina and choroid. It is true, as Dr. Schweigger admits, that with the monocular ophthalmoscope it is possible to ascertain nearly all that the binocular instrument can reveal to us; but a moment's glance with both eyes is worth an hour's gaze with one. Probably in a short time ophthalmologists will use it to the exclusion of the monocular ophthalmoscope. Time will undoubtedly simplify as well as cheapen this instrument.

B. Joy Jeffries of Boston,

Transactions of the American Ophthalmological Society, 1:7, 1865.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

444th meeting, November 19, 1958

HENRY L. BIRGE, M.D., *presiding*

FORUM ON DIABETES

MODERATOR: Edwin B. Dunphy, M.D. DISCUSSORS: Priscilla White, M.D., Hugh L. Wilkerson, M.D., William P. Beetham, M.D., and David G. Cogan, M.D.

In juvenile diabetes what is the incidence of diabetic cataracts under present types of therapy?

DR. WHITE: Cataracts in the juvenile population are seen almost at onset or shortly after with the usual history of unrecognized diabetes of a year's duration. I would say that modern management and early diagnosis are aiding in the prevention. We are now seeing juvenile diabetics with senile cataracts. They are living long enough to develop this type of cataract.

Is the control of diabetes of any value in affecting the rate of retinopathy?

DR. WHITE: It is the feeling at the Joslin Clinic that with strict control there is less chance of developing retinopathy.

DR. BEETHAM: I can answer that question in another way. You can take a series that have had poor control and compare them with a series of cases that have good control and you will see a striking difference in the incidence of nephropathy and retinopathy. Good control is the important thing.

What role does diet play in the management of diabetes?

DR. WHITE: At the Joslin Clinic we believe in a carefully regulated diet and not the so-called free diet. Not only must the diet be prescribed carefully quantitatively but also qualitatively as well. The concentrations of carbohydrates should be low. The proteins should have a high biologic value and the fat, as much as possible, of the unsaturated fatty acid variety.

Do you have any information on the use of vitamin C to improve capillary tone and reduce hemorrhage?

DR. WHITE: We have tried this with a few patients but we have not been impressed with the results perhaps because our experiment was not too carefully controlled.

How about the use of bioflavonoids in the treatment of diabetes?

DR. WHITE: We are still using them in our patients with retinopathy. At the present time we are exploring the use of enormous doses.

Is there any evidence that Orinase does not retard retinal changes as well as insulin even though the diabetes is apparently controlled as well clinically?

DR. WHITE: That is a fascinating subject and I am sorry we do not know the answer at the present time. When Orinase works by our ordinary tests, the blood and urine tests, we will sometimes achieve better control on the basis of those tests than we do in the patient on satisfactory doses of insulin. There is still some question about the peripheral action of the sulfonyureas and I think it will be 10, 15, or 20 years before the question can be answered.

If a patient survives a hypophysectomy does his vascular state continue to deteriorate?

DR. WHITE: In our experience, yes. But we have done hypophysectomy in only two advanced cases. Nobody has had the courage to do this at an early stage and most of the patients who have been operated on have been desperate.

Give the clinical differentiation of a patient with minute retinal aneurysms with diabetes ruled out?

DR. BEETHAM: Little microaneurysms

which are supposed to be 10 to 40 microns in size have been reported in many conditions: atheriosclerosis, hypertension, anemia, pulseless disease and five or six others I don't remember. But these microaneurysms in conditions other than diabetes are really rare when compared with the frequency they are found in diabetes.

What results, good or bad, have you had with the use of lipotropic substances in the treatment of diabetic retinitis?

DR. BEETHAM: I haven't had good results from the use of anything in the treatment or diabetic retinitis.

Should intraocular surgery be denied to patients with rubeosis?

DR. BEETHAM: In my opinion 99 out of 100 patients with rubeosis either have glaucoma or will have glaucoma. So you have the problem of keeping these eyes comfortable or retaining them in the orbit. Some patients insist on this. If they understand that this is all you are trying to accomplish, I think you can do diathermy or anything else you think might succeed.

Do aneurysms such as found in the retinas of diabetics also occur in the brains of diabetics?

DR. COGAN: I have heard that they have never been found, but I have not known of anyone who has looked for them. It is such an obvious possibility that I am surprised it has not been tried, that is if nobody has ever really tried it.

Are prediabetics particularly prone to cortisone diabetes? If so can this be used for a test for diabetic likelihood?

DR. WILKERSON: Theoretically the abnormality we find during pregnancy may be due to the hypercortisonism of pregnancy. A check of 150 of our cases did not show any hypercortisonism. However, there was an increase in all cases while they were in labor. This is a confusing picture because the literature would seem to say differently. We are doing some cortisone provocative glucose tolerance tests on women after they have delivered. We plan to follow these women for 15 years and we plan to follow their children for at least 15 years. It is the plan to give glucose tolerance tests with cortisone given as a provocative in at least a random sample of these women to see what it gives us. Of course, I believe the cortisone glucose tolerance test is one of the earliest tests you can do to pick up diabetes.

What do you tell your patients with diabetic retinopathy as regards to prognosis? Do you give them any local treatment, any palliative?

DR. BEETHAM: This is of course the question everyone wants answered; are they going to go blind or are they going to get better or are they going to get worse. I don't think you can answer this question with a five-minute examination. I think you have to treat them carefully and I think you have to spend 20 to 30 minutes with each patient, or even more. You have got to do everything you can do. Take the tensions, do the fields, do a careful refraction and maybe show them some of the microscopic lenses and by that time they are convinced that maybe you know what you are talking about. Then you can go on from there and tell them what your experiences have been with other cases. Now I always tell them that I have a doctor's wife that had severe retinopathy which was much worse than their's and that she maintained a retinopathy until she died. Then you can go on and say that some others got worse rapidly and you can tell them that some improved to some extent. I don't tell them, any of them, they are going to get really blind unless they come right out and ask the question. When I am pushed into a corner like this I tell them that I don't think so. Usually I tell them of some of the extremes and then I tell them I am very glad that I can't answer their question because there are all these extremes. I think you can talk around the bush quite a bit and still not be dishonest with the patient.

OPHTHALMOPLEGIA IN DIABETES MELLITUS

DR. RAYMOND D. ADAMS, Boston: Diabetic ophthalmoplegia is often seen in patients who have had mild diabetes of long

standing. Frequently the cases are complicated by retinopathy, nephropathy, peripheral neuropathy, and lenticular opacities. The third and sixth cranial nerves are the ones most frequently affected, the paralysis coming on rapidly, sometimes in a matter of hours, and clearing up completely within a few weeks or months. Frequently severe pain accompanies the ophthalmoplegia. The distribution of the pain may correspond to the ophthalmic division of the trigeminal nerve. Pupillary function often remains undisturbed when the third nerve is affected. One or both of the eyes may be affected, usually in succession.

Because there have been no pathologic reports on this condition, the subject has remained one of speculation. Our case report contains what we believe to be the first description of the morbid anatomy of the disease. A complete solution as to the cause and pathogenesis of the condition could not be given, but many of the puzzling features are accounted for.

The patient, a 62-year-old housewife, was admitted to the hospital because of ptosis of the left eyelid and a left frontal headache. She was known to have had diabetes mellitus for about 10 years and was receiving 10 units of isophane insulin daily. Her diet was not strict, and her diabetes was probably poorly regulated. She died five weeks later following the onset of the illness as the result of a carotid arteriography.

The general pathologic findings were edema and hemorrhage of the larynx, trachea, and upper esophagus; generalized atherosclerosis; intercapillary glomerulosclerosis, hyalinized islets of Langerhans, retinitis proliferans and aneurysmal dilatation of the retinal veins, and an oculomotor neuropathy.

The major pathologic changes in the left oculomotor nerve were a fusiform enlargement of the retro-orbital part of the nerve; destruction of some of the myelin sheaths and axis cylinders in the center of the nerve; an increase in the epi-, peri-, and endoneural connective tissue and suggestive regeneration in the area of destruction; Wallerian degeneration in the distal segment; axonal reaction in the left third nerve nucleus in the midbrain and arteriosclerosis of the vasa nervorum.

The lesion possessed features which were believed to be compatible with an incomplete ischemic neuropathy. However, serial sections of the nerves failed to demonstrate an occluded artery or vein. Perhaps the most likely cause of the lesion is a possible occlusion of a nutrient artery outside of the nerve.

This case established that at least some instances of diabetic ophthalmoplegia are probably due to lesions in the orbital or retro-orbital parts of the affected nerve. We were unable to identify the nature of the exact site of the lesion or to prove its specific relationship to diabetes mellitus. We could not even be sure that it differs from the lesions which must account for some of the unexplained ophthalmoplegias of nondiabetic patients.

Charles Snyder,
Recorder.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

January 15, 1959

Harold G. Scheie, M.D., *Chairman*

Choroidal detachment after cataract surgery

Dr. H. Walter Forster, Jr.: A 79-year-old man, a diabetic, had an uncomplicated intracapsular cataract extraction. The chamber was reformed with air at the end of the operation and was never shallow or flat. Choroidal detachment did not develop until after discharge from the hospital and was first discovered on the 15th postoperative day. The anterior chamber was always deep. The choroidal detachment, however, progressed until the 20th postoperative day, at which time the nasal and temporal segments

of the detachment came in contact with each other and all light perception was lost. At this point a scleral trephination in both lower quadrants was done, releasing large quantities of subscleral fluid and air was injected into the anterior chamber forcing the vitreous back. Light perception returned on the following day. The end-result was recovery of vision to 6/12 with aphakic correction. It would have been better except for diabetic retinopathy.

The discussion following the case presentation concerned the mechanism of choroidal detachment. There was no unanimity of opinion regarding the necessity for the presence of a wound leak. The case, in which the detachment occurred late, did not have one. There are a number of unanswered questions regarding the fate of the vitreous in an eye with extensive choroidal detachment. No one else present reported having seen a choroidal detachment in which light perception was lost.

Repair of orbital deformity

Dr. Robert D. Mulberger (by invitation) and Dr. G. M. Shannon (by invitation) briefly reviewed the literature on the use of polyvinyl plastic sponge material for tissue implantation.

A movie and description of the operative technique employed was presented. The authors believe that this is the first report of the material being employed to build up the orbital floor, although they realize that it has been used before by several others for this same purpose. The authors conclude that their experience with polyvinyl plastic sponge to raise the orbital floor in orbital deformity has been satisfactory.

William E. Krewson, 3rd,
Clerk.

MADRID OPHTHALMOLOGICAL SOCIETY

June 18, 1958

Dr. Marin Amat, *presiding*

Lacrimal dysfunction

Dr. Fonseca and Dr. Parra presented a discussion of two clinical cases of lacrimal dysfunction. The first case was that of a man, aged 56 years, who suffered from an intense keratitis with tearing due to obstruction of the lacrimal duct. The lacrimal sac was removed and found to have 14 small stones. Calcium concretions were present in the meibomian glands of the lids.

Case 2 was that of a girl, aged two years, who was seen with a congenital lacrimal fistula in the lateral portion of the left superior lid. Seven eyelashes emerged from the fistula. During the discussion of the cases Dr. Jimenez Jordan spoke of an ectasia of the lacrimal sac that after removal proved to be adherent to a dermoid cyst inside of which were many eyelashes.

Unilateral mydriasis

Dr. Alonso presented a case of unilateral mydriasis in a young woman. The pupil was medium sized and did not react to light, convergence, or lid movements. There had been no history of trauma; the defect appeared during pregnancy, serologic tests were negative and tendon reflexes were absent. The author therefore considers the case to be an Adie syndrome brought about by the pregnancy.

Drs. Bortolozzi, Marin Amat, and Arjona discussed the case and spoke about the pathogenesis of the syndrome.

Venous thrombosis

Dr. Riaza presented two cases of venous thrombosis of the superior temporal branch. Both were in elderly patients with symptoms of troubled vision for about two months. In

both cases, the right eye and superior temporal veins were affected. Dr. Riaza considers the prognosis of these cases to be less serious than those of central retinal artery embolism and, if early treatment is undertaken, vision may be restored.

Discussion. Dr. Marin Amat mentioned having two cases under treatment similar to the ones presented and remarked having observed that venous branch thrombosis occurs more often in the right eye and is also usually situated at a distance about a third disc diameter from the border of the disc which is frequently under pressure from a sclerosed arteriole or from rigidity of the scleral border.

Frequently these obstructions remain limited and subside after a few months into atrophy of the corresponding retina, leaving vision reduced to 1/6 to 1/10 and even less.

Dr. Mario Esteban emphasized the role of endothelial damage in central or branch venous thrombosis due to septic foci, expressed himself in favor of the use of antibiotics and against anticoagulants when the occlusion had already been established. He considered anticoagulants beneficial as a preventive measure against repetition of other branch occlusions.

Sarcoma of choroid

Dr. Arjona presented a case, diagnosed clinically as sarcoma of the choroid in which the laboratory examination of the fluid obtained by puncture showed the presence of equinococci. The patient was a man with no vision in one eye, with slight turbidity of the media, and a dark detached retina. A sarcoma was suspected and a puncture was performed in search of neoplastic cells.

Discussion. Drs. del Rio and Bartolozzi justified the enucleation of a blind eye in which the laboratory may sometimes not find a sarcoma since early diagnosis is the safest way to avoid metastases.

Dr. Jiménez Jordon cited a case in which the exploratory puncture permitted the exact diagnosis of neoplasm.

Dr. Arjona explained the difficulties and importance of early diagnosis and mentioned a case of late orbital metastases.

Interstitial keratitis

Dr. Jiménez Jordan presented a case of interstitial keratitis in a child with hereditary lues and a positive Wassermann. The parenchymatous keratitis occupied the central portion of the cornea and was similar to the virus interstitial keratitis except that the blood examination demonstrated its syphilitic origin. Nowadays these types of cases are becoming rare.

Discussion. Drs. Arjona and Bartolozzi made reference to the low incidence of this keratitis as compared to its former frequency and Dr. Bartolozzi mentioned the usefulness of slitlamp examination for early diagnosis.

Dr. del Rio Cabañas presented "A case of Marcus-Gunn syndrome associated with a paralytic strabismus."

Olga Ferrer,
Translator.

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THE EVOLUTION OF THE EYE

Darwin in *The Origin of Species,* published a century ago (November 24, 1859), established the mutability of species and accounted for the evolutionary process by the mechanism of natural selection. His book discussed the difficulties in comprehending how natural selection could evolve from chance variations such a complicated and co-ordinated organ as the human eye. Darwin stressed that vision resulted from a continuous adaptive response of living matter to light and that any favorable mutation, however subtle and minute, gave its possessor a better chance for surviving the challenges of environment. From this viewpoint the evolution of sight seems easier to grasp than that of flight since the wings of birds could conquer the air only if powerful and fully developed.

The simplest protozoa exhibits a surface photosensitivity that steers the organism to

its optimum environment. In the ameba this is attributed to a change in viscosity of its outer layer. The photomotor response increased in efficiency with the successive evolution of specialized light-sensitive cells in the anterior part of the organism, the addition of insulating and sensitizing pigments and of focusing devices to concentrate the light. In both plant and animal kingdoms the light-sensitizing pigment is derived from carotenoids. Indeed, the yellow pigment of the human macula is xanthophyll, the same carotenoid that mediates photoreception in plants. The derivative vitamin-A systems, essential for image formation, are similar in eyes as widely diverse as those of man and the octopus.

In Invertebrates, the retina, derived from the surface ectoderm, is connected secondarily to the nervous system. In Vertebrates, however, the eyes arise from the neuroectoderm and a multilayered retina assumes the function of the invertebrate optic ganglion. Though the vertebrate retina is always inverted and the invertebrate retina is usually erect, as in the octopus, inverted retinas are seen in six of the spider's eight eyes and in the eyes of the scallop.

Ray Lankester (1880) suggested that the original prevertebrate eye was buried in the central nervous system as in the larval seasquirt—of the protochordate division which includes Amphioxus. He assumed that light traversed the transparent body; and that as the body became more opaque with the process of evolution, the eye travelled gradually to the surface. The transparent media of the eye are modification of structures retaining the primitive transparency. The cornea, for example, resembles the integument of Amphioxus.

The neural tube came into being before the vertebrate retina could evolve. A suggestion of its incipiency is the median infundibular organ of Amphioxus, considered by Walls to be derived from photosensory ependyma. Lebоucq (1909) and Studnička (1912) traced the rods and cones to the flagellae of ependymal cells, a conception that brings them in line with sensory hair cells in general. Rods and cones are homologous but the course of evolution intimates that the cones are the older form since diurnality was the primitive status of Vertebrates. The lens, as shown by experimental embryology, is a secondary structure called forth by a chemotactic response to the developing optic cup. The first function of the semisolid vitreous was to prop the lens in place, as the eye of the lamprey demonstrates. Accommodation was effected by diverse methods as exemplified in the fish, bird, horse, and man. The fibrous and vascular coats of the eye are probably extensions and modifications of the meningeal envelopes —dura mater and pia arachnoid respectively.

The pupil is fixed in lampreys and fishes and attains maximum motility in mammals. With the rapid equalizing device of an active iris there is no further need for the photomechanical changes of pigment migration employed by the retinas of primitive forms. With evolution the acuity requirements steadily increase. Consequently in man the posterior segment becomes larger so that the visual cells are more numerous per angular unit of image, and the lens becomes flatter to be adapted for the greater focal distance. In the rabbit the depth of the vitreous chamber is less than the anterior-posterior diameter of the lens; in man it is about three times as great.

Independently evolved, well-developed eyes are found in many unrelated forms—molluscs, cephalopods and vertebrates. The ancestral vertebrates had a third eye, directed upward. In fossil ostracoderms, a socket for this eye is universally present, although much smaller than those for the paired eyes. Despite loss of function, the third eye persists, transformed into the pineal body.

The vexing problems of the ancestry of the Vertebrates and of the Primates have been clarified. The best clues to chordate origins are found in the echinoderms. Their

larvae, which exhibit bilateral symmetry, resemble the larval forms of protochorates; and unlike other invertebrates, the echinoderms use creatine phosphate instead of arginine phosphate to spark the energy release for muscle activity. The earliest phase in the evolution of the Primates is represented approximately by the tree-shrew. In contrast to the true shrews, which are properly classified as Insectivores, the tree-shrew has a high visual development. Arboreal life has greater use for the sense of sight than that of smell upon which the ground dweller depends so much.

An outstanding feature in the evolution of the Primates is the progressive elaboration of the sense of vision. The orbit becomes protected by a complete ring of bone and almost entirely shut off behind by a bony wall. In the higher Primates the orbital apertures become directed forward and stereoscopic vision was developed as a distinctive acquisition. Movement of the globe in all mammals below monkeys is slight. The closing in of the orbits favored steadiness of ocular motion. In mammals below man, the diameter of the cornea measures more than half the anterior-posterior diameter of the globe. The relatively smaller cornea sacrifices the monocular field but secures more acute central fixation. The Primates alone have a fovea. In apes and man, the ciliary muscle has longitudinal, radial and circular fibers; in all other mammals, only longitudinal fibers.

The prehuman line branched off the anthropoid stock about 35 million years ago. The existing species of man is only one of a number of human species, the rest of which have become extinct. The earliest fossils of modern man date back 25,000 years. The most marked trend in the evolution of man has been the special development of the brain. "Human vision is the product of a complex brain teamed with a relatively simple eye."

We've traced Man through the Anthropoids, the Reptiles and the Fish
And via Pro-chordata to Echinoderms and such,
Till we reach the Protozoa; and then we guess beyond—
Past the earthly carbons out to the solar bond—
There! there! where free electrons fly
Approach we the Ultimate from whence came you and I.

James E. Lebensohn.

1959 ACADEMY MEETING

The 64th annual session of the American Academy of Ophthalmology and Otolaryngology was held at the Palmer House, Chicago, October 11th to 16th. The total registration was 6,653, including more than 4,200 physicians. This was one of the largest, if not the largest, session in the history of the Academy. Many guests from other countries were present.

The president, John H. Dunnington of New York, chose as the subject of his address, "Interdependence." In this he developed the theme that, as time has gone on, the scientist has come out of his laboratory to meet with the physician at the bedside, and vice versa, with wonderful benefit to the patient. If the scientist in this process has become humanized, the physician, in gaining more scientific knowledge, seems to have lost much of the precious art of medicine. This is not good and Dr. Dunnington believes that we must cultivate, as never before, humility of approach and tender, loving care of our patients.

In introducing the guest-of-honor, Georgiana Dvorak-Theobald, M.D., of Oak Park, Illinois, the first time that a woman has been so honored by the Academy, Dr. Dunnington paid a glowing tribute to her as a scientist and investigator, a physician, a friend, a leader, and a great teacher. "But above all," he said, "she is one of the most loved figures in American ophthalmology." The prolonged and standing ovation from the floor confirmed this expression of affection and esteem.

Dr. Theobald, under the title of her address, "Women and Medicine," gave a

charming and delightful historical survey of the part that women have played in the field of medicine since several centuries before Christ up to the present. The acceptance of women as physicians, by patient and colleague, has had a difficult past, especially during the 19th century. Now, however, it is entirely different and women physicians are the equals of men, and their future careers in the fields of medicine are completely assured. Her address was witty and modest. Those of us who might have expected a militant and belligerent talk concerning the battle of the sexes were humbled in the dust and overawed. There is no doubt in any of our minds that Dr. Theobald has contributed very much indeed to the prestige in medicine that women now hold.

At this opening session, honor awards for 1959 were presented in person to 21 members for their contributions to the programs of teaching in the Academy, through the years. This is a happy ceremony of recognition and gratitude.

The joint session concluded with an address on "The proper use of tranquilizers," by E. M. Papper, M.D., of New York, and also, by invitation, an informative lecture on the "Proper use of antibiotics," by G. C. Jackson, M.D., of Chicago.

The next morning's session was presided over by S. Rodman Irvine, M.D., of Los Angeles, the vice president. Our old friend and fellow member, Helenor Campbell (Wilder) Foerster, a distinguished woman in medicine, now of San Francisco, gave an interesting clinicopathologic case report on "Mycosis fungoides with ocular involvement." Then followed the showing of an extraordinary film, "Cinematography of human retinal vessels," by Kenneth S. Swan, M.D., and P. Bailey, Jr., of Portland, Oregon. With improvements to come, cinematography of the retinal vessels may provide us with a method of great value in recording the pulsations in the vessels and the movement of blood under high magnification.

The rest of the morning's session was taken up with a most instructive symposium on "Office management of the primary glaucomas." The moderator was Bruce Fralick, M.D., of Ann Arbor. George M. Haik, M.D., of New Orleans, discussed the history, signs, and symptoms. Robert N. Shaffer, M.D., San Francisco, talked on gonioscopy, visual fields, slitlamp and fundus examinations in the diagnosis. Bernard Becker, M.D., Saint Louis, described tonometry, tonography, and provocative tests in the management of the glaucomas, and the subject of medical therapy was given by W. Howard Morrison, M.D., of Omaha, Nebraska. This timely symposium should be of great value, when published, to every ophthalmologist who works alone in a busy clinical practice.

The next morning's (October 14th) session, under the direction of President Dunnington, opened with a clinicopathologic case report, "Proliferative chorioretinitis of the macula due to nematode larvae," by Prof. Norman Ashton of London, one of our cherished members. In his absence, the paper was adequately presented by J. A. C. Wadsworth, M.D., of New York.

Then followed the XVIth Jackson Memorial Lecture, sponsored by THE JOURNAL. It was given by Prof. Jules François of Ghent, Belgium, who is well known and popular in this country. His subject, "Syndromes with congenital cataracts," well illustrated, described in detail unusual syndromes, many of which were not familiar to us. His recent book (1958) on *L'Hérédité en Ophtalmologie* (Paris, Masson et Cie) which, incidentally, he is translating into English and is to be published by C. V. Mosby, Saint Louis, reveals to us his extraordinary capability in this field. His Jackson Lecture was widely appreciated.

Then followed a case history and remarkable colored motion picture of "Unilateral intermittent spontaneous dilatation of retinal veins of undetermined etiology associated with blindness," by D. W. Longfellow, M.D., F. S. Davis, Jr., M.D., and F. B.

Walsh, M.D., of Baltimore, and M. C. Brown, M.D., of Bethesda, Maryland. The case was one of intermittent attacks of engorgement of the retinal veins in the left eye in a young man. Temporary blindness in the affected eye ensues during the attack but vision returns as the engorgement subsides. No cause was found for this phenomenon.

J. H. King, Jr., M.D., Washington, D.C., S. B. Chavan, M.D., Hyderbad, India, and J. T. McTigue, M.D., Washington, D.C., reported on their experiences with vitreous preserved by lyophilization. They found that such vitreous, even when stored for a long time, when rehydrated resembles fresh vitreous and appears to have certain advantages when used for implantation in retinal detachment.

The subject of "Facial pain," was discussed by A. P. Friedman, M.D., and C. A. Carton, M.D., of New York. This difficult clinical problem was well covered by the authors, although little new was added to our knowledge.

The long-awaited report of the Committee on the Use of Alpha Chymotrypsin in Ophthalmology was next on the program. B. Schwartz, M.D., Ph.D., New York, described the chemistry and pharmacology of this enzyme. L. von Sallmann, M.D., of Bethesda, Maryland, next reported the results of some experiments he and his groups performed on (a) the question of allergy (chemically no effect), (b) the damage to the endothelium (some, but little more than that produced by 0.9-percent saline solution), (c) the definite zonulolytic action of the enzyme (fragmentation).

A. E. Maumenee, M.D., Baltimore, reported on his experiments of the injection of the enzyme into the vitreous (results, damage to Mueller's fibers). R. C. Troutman, M.D., New York, summarized in capsule fashion the analysis of 1,581 case reports of the use of alpha chymotrypsin gathered from questionnaires sent widely throughout the country.

The analysis represented an enormous amount of work, mostly statistical, and was not quite complete by the time the report was presented. However, among other things, the report seemed to show that use of this enzyme as an adjunct to cataract surgery did not seem to produce any more or different complications than those seen following the usual cataract operation, with the exception of an increase in the number of cases of striate keratitis and an incidence of 0.2 percent of posterior dislocation of the lens. Its use did definitely facilitate the operation (an impression becoming a fact through the report of a double-blind study by B. Schwartz later on in the session). It likewise markedly reduces the incidence of ruptured capsules.

Derrick Vail, M.D., chairman of the committee, concluded with a detailed summary. The committee concluded that (a) a long-term study of the 1,581 cases should be carried out, with particular reference to the question of later retinal separation; (b) certain contraindications for its use, chiefly in patients under 20 years of age, those with Fuchs' dystrophy of the cornea, traumatic cataracts and dislocated lenses; and (c) continued conservatism and reserve until more information is forthcoming.

Henry F. Allen, M.D., of Boston finished the morning's session with an excellent report on "Recent advances in aseptic surgical technique." He described newer methods of gaseous sterilization and pleaded for more stringent precautions by hospitals, clinics, and private offices.

The October 15th scientific session, under the chairmanship of Dr. Irvine, began with a clinicopathologic case report of "Juvenile melanoma of the uvea," by A. B. Reese, M.D., and R. M. Ellsworth, M.D., of New York. The patient was a boy, aged three years, whose right eye showed a tumor of the base of the iris, suggestive of melanoma.

The excised eye showed melanoma of the choroid.

A. Jampolsky, M.D., E. Marg, Ph.D., and E. Tamler, M.D., of San Francisco, showed

an excellent motion picture of "Human ocular electromyography." The technique and results were effectively shown.

Then followed a symposium on "Corneal surgery." In 1948 a symposium on this subject was held by the Academy. The present discussion revealed most dramatically the striking advances in this field that have taken place since then. R. T. Paton, M.D., of New York, was the able moderator; A. E. Maumenee, M.D., Baltimore, discussed the biologic responses to corneal homografts, a subject with which he has long been identified; Max Fine, M.D., San Francisco, described therapeutic keratoplasty and showed slides demonstrating remarkable results of this action in a variety of acute and chronic corneal diseases. R. Castroviejo of New York, contributed a paper on instrumentation and technique that strikingly revealed the great advances that have occurred in the last few years in this subject. It was a good symposium.

F. Phinizy Calhoun, Jr., M.D., Atlanta, Georgia, showed a motion picture of the "(J) Barraquer method of removing a dislocated lens." Dr. Calhoun, used a cleverly designed sharp bident which was inserted through the eyeball in the ora serrata zone behind the dislocated lens and, bringing it forward, then removed the lens. The operation ought, however, to be called after C. R. Agnew of New York, who described both the instrument and the same technique in 1885 (see Tr. Am. Ophth. Soc., 4:69, 1885). The results described by Dr. Calhoun were excellent and the operation is worthy of being revived.

The next item on the program was a paper by O. H. Ellis, M.D., of Los Angeles. His subject was "Foreign bodies and injuries of the ciliary body." This was a good review of the subject and was followed by a lively discussion by W. B. Clark, M.D., of New Orleans.

The morning's program was concluded by a paper by Lee Allen, A. E. Braley, M.D., and E. C. Ferguson, III, M.D. of Iowa City. Their topic was "A quasi-integrated buried muscle cone implant with good motility and advantages for prosthetic fitting." This implant with three knobs is held in place by the carefully sutured rectus muscles and covered with conjunctival closure. It is too soon to evaluate the results that appear to be promising.

The final session held on October 16th, with President Dunnington in the chair, opened with a clinicopathologic case report by F. C. Blodi, M.D., Iowa City, on "Retinal involvement in idiopathic hyperlipemia." The histologic examination showed numerous fat-staining deposits in the retina.

Following the presentation of some new instruments, R. Castroviejo, M.D., described the results he obtained with his operation of scleral shortening by outfolding with Titanium metal clips, in 50 selected, unfavorable cases of retinal detachment. His statistics revealed that this operation, easy to perform, offers possibilities as an alternative method of scleral shortening.

D. C. Cancino, M.D., then showed a remarkable motion picture of "Perforating keratoplasty in total staphyloma of the cornea." The end-result of this drastic procedure was extraordinarily good.

C. Kennedy, M.D., of Philadelphia, and Frank Carroll, M.D., New York, analyzed 41 cases of optic neuritis in children seen at the Columbia-Presbyterian Medical Center over the past 25 years. The etiology in 22 of the cases was unknown. Eight of the patients developed multiple sclerosis later. C. W. Rucker, M.D., Rochester, Minnesota, in discussing this paper, likewise analyzed 41 cases seen at the Mayo Clinic and came up with somewhat the same figures. Both agreed that patients having no treatment at all did as well or even better than those who had treatment of various sorts.

J. F. Toole, M.D., Philadelphia, A. M. Potts, M.D., Cleveland, and M. C. Brown, M.D., Bethesda, Maryland, showed a well-planned motion picture on "Ophthalmodynamometry." It was a beautifully executed

teaching film. It showed the technique and value of this procedure in the diagnosis of carotid artery occlusion. A striking feature of the film was the demonstration of the use of a colored television ophthalmoscope in evaluating the end-points of retinal vascular pressure.

L. Christensen, M.D., and C. DuVall, M.D., of Portland, Oregon, described their operation of "Cyclodiathermy with scleral flap." By this method, diathermy is applied directly to a selected area of the ciliary body, thus avoiding extensive damage to the overlying sclera.

R. W. Olmstead, M.D., A. M. DiGeorge, M.D., Philadelphia, and R. D. Harley, M.D., Atlantic City, next drew our attention to "Waardenburg's syndrome." They presented the findings of this syndrome in two Negro families (the first such report). They also described five additional cases uncovered in a routine survey of an institution for deaf children in Philadelphia.

Kevin Hill, M.D., Boston, in discussing, "The nature of the antibacterial effect of human vitreous" showed that the antibacterial activity of human vitreous samples is due to the presence of antibiotics administered systemically to the donors shortly before the aspiration of the vitreous or applied to the eyes after enucleation.

The final paper by J. W. McMeel, M.D., and R. M. Wood, Ph.D., Baltimore, was on "Active and passive immunization against Pseudomonas infection of the cornea." This was a most interesting report of experimentally induced, effective immunization in rabbits by the use of Pseudomonas-immune gamma globulin.

The afternoons were occupied by the usual instruction courses for which the Academy is justly famous. The number of courses and instructors was greater than ever and each was either a sell-out or nearly so.

The usual special scientific programs, teachers' section, conservation of hearing and otosclerosis study group, the American Orthoptic Council and American Association of Orthoptic Technicians, the Committee on Reconstructive Plastic Surgery and the American Society of Ophthalmologic and Otolaryngologic Allergy, were held at odd hours, and fitted into the busy week somehow or other.

The scientific exhibits were very good indeed and covered a wide variety of subjects. DuPont Guerry, III, M.D., W. A. Lieb, M.D., and W. J. Geeraetes, M.D., received the first ribbon for the exhibit on anterior chamber lenses. (But as President Dunnington said: this does not mean that the Academy endorses the use of this lens.) The second ribbon was won by E. Okun, M.D., of Saint Louis, for his beautiful display of colored photographs of retinal tears in eyes examined at autopsy. The third ribbon was awarded to L. E. Zimmerman, M.D., Washington, D.C., and S. T. Jones, M.D., Portland, Oregon, and W. F. Hughes, Jr., M.D., Chicago, representing the Armed Forces Institute of Pathology, Washington, D.C., for their fine exhibit of a clinicopathologic study of the cornea.

The commercial exhibits were more numerous and better than last year and attracted swarms of interested physicians eager to see and to purchase the latest in instruments and equipment.

The usual social activities, such as the banquet and floor show, the alumni dinners, and innumerable cocktail parties, took up every minute of the available time left. No one seemed to bother very much about sleep.

The meeting was one of the best and happiest. President Dunnington and his gracious wife brought prestige to the office and charm to the members.

The next meeting will be held the second week in October, 1960, at the Palmer House, as usual. The new officers are: President, Dean M. Lierle, Iowa City; president-elect, Dohrmann K. Pischel, San Francisco; first vice president, Harold G. Scheie, Philadelphia; second vice president, D. R. Higbee,

San Diego; third vice president, James H. Allen, New Orleans. The new councilor is H. P. Schenck of Philadelphia.

Derrick Vail, M.D.

OBITUARIES

JOHN W. BURKE
(1885-1959)

Dr. John W. Burke was born in Alexandria, Virginia, on October 7, 1885, and died in Washington, D.C., on October 5, 1959, of cardiovascular disease.

Dr. Burke did his premedical work at the University of Virginia and was graduated from the University of Virginia Medical School in 1906. While at the university, he was a member of the track and football teams.

He interned at the University of Virginia Hospital, the Episcopal Eye, Ear and Throat Hospital, and the New York Eye and Ear Infirmary. He then did postgraduate work in Vienna and London.

In 1910, he returned to this country to private practice of ophthalmology as an associate of the late Dr. William Holland Wilmer. In 1917, he was commissioned a first lieutenant in the Medical Corps, United States Army, and served in France until he was released in 1919 as a Major. He returned to the United States on a Navy ship, as one of the personal physicians of President Woodrow Wilson.

He was an associate professor of ophthalmology at Georgetown University Hospital and later professor. He was a member of the American Ophthalmological Society. He had been a member of the council and was president in 1947. He also was a member of the American Medical Association and of the District of Columbia Medical Society.

He was not a prolific writer but his greatest contributions were in doing the first total corneal transplant and in pointing out that there could be progressive field loss in advanced glaucoma with controlled tension.

JOHN W. BURKE, M.D.

He was an enthusiastic outdoor man, a hunter and a fisherman. He was also a devoted churchman, having served on the vestry of his church for more than 30 years, and had been senior warden the past 12.

In 1912 he married Elizabeth Atkinson, who died in 1946. In 1954, he married Mrs. Olive Latimer Patten, widow of James Patten. He is survived by his widow, two daughters, Mrs. Richard Emory of Baltimore and Mrs. Arthur Howe, Jr., of New Haven; one son, John W. Burke, Jr., of Washington, and nine grandchildren.

Harold R. Downey.

* * *

The sweet character of Jack Burke cannot be enclosed by a few austere words covering his long career in ophthalmology. To be sure he was a most skillful eye surgeon, and his professional knowledge, wisdom, and

judgment were superior. He was a dedicated physician and his patients loved him dearly. His blithe spirit, elfin wit, and humor endeared him to his many friends and those of his colleagues who were honored with his intimate friendship. Hospitable, generous and kind, he brought great joy to his companions in his home, his clubs, at medical meetings, in the hunting field, on the golf links and across the dinner table. He had an endless stock of witty stories, not one of them coarse or rude or mean, that he delighted to tell in front of a small, highly appreciative audience. He was deeply religious, which he never paraded, and his strong faith supported him through many tragic hours in his life, and sustained him courageously during his final days. He was a gentleman, scholar, wit and raconteur, a most uncommon man of rare integrity. We mourn his death.

Derrick Vail.

ROBERT RUTSON JAMES
(1881-1959)

Few American ophthalmologists have had the pleasure of knowing Mr. James personally. Yet his name and the influence of his works are familiar to all of us, and it is with sincere regret that we learn of his death on September 28, 1959. According to the *Lancet* (17 October 1959), "He was born in 1881 in a west county parsonage and was educated in Winchester College. He qualified from St. George's Hospital in 1905, and the following year gained the F.R.C.S. After holding house appointments at St. George's Hospital, he worked at Moorfields Eye Hospital under Mr. William Lang and Sir John Parsons and at the Royal Westminster Ophthalmic Hospital under Brewerton and MacMullen. In 1909 he was appointed to the consulting staff of St. George's Hospital at the age of 28 and he became dean of the medical school after the 1914-18 war.

"From 1924 to 1948 he was editor of the *British Journal of Ophthalmology*, and from 1939 to 1945 of the *Transactions* of the Ophthalmological Society of the United Kingdom. He had already served the society as secretary (1915-1921) and as Bowman librarian (1924-27) and his work was recognized by his election as an honorary member."

In 1933 appeared his delightful *Studies in the History of Ophthalmology in England Prior to the Year 1800*, published by the Cambridge University Press. He chose as one of the mottoes for this work a verse from *Ecclesiasticus* (44:1) "Let us now praise famous men and our fathers that begat us." This book written in lucid and impeccable English reveals evidence of wide reading and deep scholarship. The first eight chapters are written by James, the last two by the late George Coats, F.R.C.S., who gives us one of the most complete "lives" of the notorious 18th century quack, the Chevalier Taylor, to be found anywhere.

Ophthalmologists who are not aware of or familiar with Mr. James' book will have a rewarding experience in reading it.

We honor his memory.

Derrick Vail.

CORRESPONDENCE

Occlusion of cilioretinal artery

Editor,
American Journal of Ophthalmology:

In the article of Dr. M. Wallace Friedman on "Occlusion of the cilioretinal artery" which was published on page 684 in the May, 1959, issue of The American Journal of Ophthalmology, the author stated that he was unable to find a previously reported case.

I reported a typical case and reviewed the main findings in six previously reported cases in the *Archives of Ophthalmology*, August, 1948, Volume 40, pp. 152-156.

(Signed) Jesse M. Levitt,
Brooklyn, New York.

Editor,
American Journal of Ophthalmology:

It has been brought to my attention that in the *Archives of Ophthalmology*, August, 1948, Dr. Jesse M. Levitt reported a case of the occlusion of the cilioretinal artery and reviewed six cases previously reported.

I regret that in my review of the literature this reference was overlooked.

(Signed) M. Wallace Friedman,
San Francisco, California.

BOOK REVIEWS

PARSONS' DISEASES OF THE EYE. By Sir Stewart Duke-Elder. New York, The Macmillan Company, 1959, 13th edition. 586 pages, 22 colored plates, 459 text figures, appendices, index. Price: $8.75.

The 12th edition of the well-known book appeared in 1954. Sir John Parsons was then alive but in retirement, and he delegated the task of bringing out this and future editions to his favorite pupil, Sir Stewart Duke-Elder. In the last five years our science has experienced many advances and increases in our knowledge and techniques. It was therefore no small task that Sir Stewart had undertaken. It is safe to say that no one else could have accomplished this job so efficiently, yet preserving the spirit and flavor of the original texts that go all the way back to the first edition which appeared in 1907. A most worthy and loving pupil of a very great teacher has done a fine job.

This edition, with some "rearrangement in the sequence of the subjects discussed," is of course reliable and up to the minute. In his preface the author says, "The general philosophy of the book, however, has been retained in the hope that it will remain a concise and reliable guide to the diseases of the eye for students, general practitioners, and junior ophthalmic surgeons."

This hope is amply fulfilled for it is a remarkably concise and clear exposition of the subject, worthy of being in the library of all ophthalmologists, even the most experienced.

A valuable addition is that of Appendix II covering therapeutic preparations. The dosages are given in metric measures and the list is complete and as up to date as the transistor radio. The first thing you know the British coins will be in decimals and autos will be driven on the right side of the road.

This delightful textbook is the ophthalmic bible for all medical students throughout the Commonwealth. It deserves the same character in every country where English is read and spoken.

Derrick Vail.

DISEASES OF THE NOSE, THROAT, AND EAR. Edited by Chevalier Jackson, M.D., and Chevalier L. Jackson, M.D., with the collaboration of 61 authorities. Second Edition. Philadelphia, W. B. Saunders Co., 1959. 886 pages, 1193 illustrations including 16 plates with color, chapter bibliographies, index. Price: $20.00.

Since the first edition of this book in 1945 such progress has been made in the specialty of otorhinolaryngology that the second edition has been entirely rewritten. Some of the sections carried on were thoroughly revised by their respective authors; but for many sections new articles by new authors have been substituted.

In the new article on the relationship of ear, nose and throat disease to ophthalmology Berens and Breaky have advanced numerous original concepts. They have noted that patients with complicated retinal detachments, recurrent corneal ulcers and persistent uveitis often have some related nasopharyngeal disease. In chronic simple glaucoma Berens found a greater nasal involvement on the side of the eye with the more active glaucoma; and in no instance was there marked nasal pathology on one side associated with a markedly active glaucoma on the other side. Patients with nasopharyngeal tumors may show trigeminal

neuralgia, palsy of the third, four or sixth nerves, exophthalmos or Horner's syndrome. The most common causes of the superior orbital fissure syndrome are aneurysm of the internal carotid artery, meningioma of the sphenoidal ridge and inflammatory lesions. For orbital tumors the Krönlein operation is favored in opposition to the transcranial approach of Dandy. In chronic cases of optic neuritis which do not yield to medical treatment, sinus disease should be investigated. Infection of the posterior sinuses can cause inflammation of the arachnoid coat covering the chiasm and optic nerves. The diagnosis of optochiasmatic arachnoiditis rests on pneumoencephalograms showing typical patterns of adhesions or obliteration of the basal cisterna in the region of the optic chiasm (Vail, 1938). The allergic aspects of focal infection play an important role in some cases of uveitis, retinal detachment, and ocular inflammations.

The common ground of ophthalmology and otorhinolaryngology is annually stressed at the opening session of the American Academy of Ophthalmology and Otolaryngology. Were it not for the increasing fission of the specialties, these sessions would probably have inspired by now a fine textbook on the subject.

James E. Lebensohn.

PATHOLOGY OF TUMOURS OF THE NERVOUS SYSTEM. By Dorothy S. Russell and L. J. Rubinstein. (With a chapter on "Tissue culture in relation to tumors of the nervous system," by C. E. Lumsden.) London, Edward Arnold, Ltd., 1959. 309 pages, 286 figures, references, index. (The Williams and Wilkins Company, Baltimore, exclusive United States agent.) Price: $13.50.

Dr. Russell is the director, Bernhard Baron Institute of Pathology, London Hospital, and professor of morbid anatomy, University of London. Dr. Rubinstein is lecturer in morbid anatomy, London Hospital College, and Dr. Lumsden is professor of pathology, University of Leeds, and honorary consultant pathologist, General Infirmary, Leeds.

This authoritative and beautifully illustrated book is of interest and value to all ophthalmologists, both as a text and reference book, since our field of activity overlays that of the neurologist and neurosurgeon in large measure.

There are 14 chapters that cover in a most interesting fashion the entire subject. Chapter 8 discusses tumors of the retina, optic nerve, and neurohypophysis and should be of particular interest to us.

The work supplements Reese's *Tumors of the Eye* to a remarkable degree and the two should be used together. It is an excellent job and highly recommended.

Derrick Vail.

CONCERNING THE EDUCATION OF BLIND CHILDREN. (Ten papers. Compiled by Georgie Lee Abel.) New York, American Foundation for the Blind, 1959. Paperbound, 107 pages, bibliography. Price: $1.00.

Of the 350,000 blind persons in the United States, 10 percent are under 20 years of age and 2.5 percent under six. Before 1953 when the etiologic role of excess oxygen in retrolental fibroplasia was established, one child of every 4,000 births became blind because of this condition, while in 1956 only three cases were reported in the state of New York. The attendance of blind children in regular nursery schools has helped their further integration in the public school systems. Residential schools now prepare children for this goal so that the youngsters can continue their education in the schools of their home communities. The education of blind with sighted children is an American innovation that extends back only 40 years. Influential in the development of this program were three blind educators—John Curtis of Chicago, George Meyer of Minneapolis, and Robert B. Irwin of Ohio. The itinerant

teacher of the blind arranges for the special educational needs of the blind including the transcription of the currently used texts in braille or on records. Volunteers assist in large-print typing for the partially seeing, in reading, recording and in braille transcribing. With the development of effective optical aids many students have been transferred from braille to sight-saving classes. Notwithstanding the other helps, braille still retains its position as the most valuable tool ever devised for the blind.

James E. Lebensohn.

L'Ophtalmologie Française au XX° Siecle. By René Onfray. (Preface by Prof. G. Renard.) Paris, Masson et Cie, 1959. 236 pages, table of contents. Price: 2,200 francs.

This book by an ex-secretary-general of the French Society of Ophthalmology was awarded the 1957 Burgkly prize of the Academy of Medicine. Dr. Onfray of Paris, one of the shining stars in the firmament of French ophthalmology, reviews for us the achievements and contributions of Frenchmen to the science of ophthalmology since the beginning of this century. It is an impressive record of great accomplishment in spite of two devasting wars, foreign occupation, demoralization, inflation, domestic trouble, and frequent changes in government and policy. The book represents an extraordinary effort to collect the details of the writing of the colleagues of the author who cover every subject in ophthalmology. It is a task of supreme patriotism and justified pride.

The work does not lend itself to review. There are many gems of information displayed—some new, some old. It is a catalogue of medical history and not a textbook. But it is written with great skill and lucidity. It is fun to read and makes us admire our gallic friends with unabashed enthusiasm. It should be an inspiration to the young ophthalmologists of glorious France.

Derrick Vail.

Social Group Work with Deaf-Blind Adults. By Donna Verstrate. New York, American Foundation for the Blind, 1959. 55 pages, paper-bound. Price: 75¢.

Nearly all the deaf-blind are congenitally deaf and became blind later in life. Communication is by the one-hand manual alphabet—a system in which each word is spelled into the palm of the reader. At the New York Industrial Home for the Blind 22 deaf-blind men were helped to organize into a group that met monthly for recreation sessions preceded by dinner and a business meeting. Of these, 17 lived in the resident dormitory and five in the community. The members fell into four major subgroups: leaders, secondary leaders, followers, and isolates. The recreational program focused on the introduction of new activities. Those not completely blind were encouraged to use their little vision in games such as pool. In the popular dancing sessions the phonograph was placed on the floor of the auditorium so that the rhythmic vibrations could be felt. Records with strong percussions were selected. Occasionally live orchestras were used, with strong reliance on the drum beat.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Wolter, J. R. **The trabecular endothelium.** A.M.A. Arch. Ophth. 61:928-938, June, 1959.

Using the silver carbonate staining techniques of del Rio Hortega, the trabecular endothelium of the eyes of a two-months-old child were studied and the excellent photomicrographs are published. Very distinct differences in staining characteristics between the endothelium of the cornea and of the trabeculum were noted and this is taken as further evidence that the endothelial cells of these two areas are different in nature and function. Many branching nerve fibers were seen within the trabeculum and the terminal branches were seen in the trabecular endothelium. No special nerve end organs were seen.

The changes of the trabeculum in two cases of angle-closure glaucoma after cataract surgery were studied. In an eye with an epithelial cyst in the anterior chamber there was complete and total atrophy of the endothelium, whereas in one which had a flat anterior chamber after cataract surgery there was extensive atrophy and degeneration of the endothelium. There was also some distinct fragmentation of the collagen fibers of the trabeculum. This extensive atrophy of the trabecular endothelium is felt to be a new observation. (16 figures, 12 references) W. S. Hagler.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Beattie, C. D. **Toxoplasmosis.** Tr. Ophth. Soc. U. Kingdom 78:99-107, 1958.

If the toxoplasmas are of low virulence or the host resistant the cyst may persist for long periods without apparent damage to the host. Toxoplasma infection may be detected by isolation of the parasite or by inoculation of excretions, secretions or suspensions of tissue taken by biopsy or autopsy into susceptible animals (mice or hamsters). Demonstration of toxoplasma may be shown in smears or sections but the only form to be sure of is the cyst. Direct evidence for the ophthalmologist must rest on antibody tests, the complement fixation and the dye test or the skin reaction for allergy. These

methods have shown that the distribution of toxoplasma infection is amazingly wide. All species of mammals and birds are often infected.

The toxoplasmas have been isolated from cats and dogs. Toxoplasma are discharged in the excreta of infected animals and from the saliva of a child. The infection appears as congenital toxoplasmosis if acquired by the child in utero from the mother who acquired the infection herself in the second half of the pregnancy, when it is almost always latent, but may lead to clinical toxoplasmosis.

Healing can take place in utero; if acquired late in the pregnancy the baby may be born with generalized toxoplasmosis, jaundice, rash, an enlargement of the liver and spleen. This overshadows manifestation of damage to the eye and brain. If infection is acquired earlier the only persisting damage at birth will be in the brain and the eye, shown by the classical tetrad of signs, hydrocephalus, intracerebral calcification, signs of nervous involvement and chorioretinitis. Other eye manifestations are optic neuritis, optic atrophy, iritis, iridocyclitis, cataract, microphthalmia, nystagmus, strabismus and persistant pupillary membrane.

Acquired toxoplasmosis is always latent. It can result in a generalized typhus-like disease and, sometimes, especially in children, it has resulted in encephalitis. It can cause myocarditis. The commonest form is lymphadenopathy which must be differentiated from infectious mononucleosis. High or rising antibody titers are likely to be found in recent infections. (5 tables)

Beulah Cushman.

Kreibig, W. **Zoster disease of the eye.** Klin. Monatsbl. f. Augenh. **135**:1-31, 1959.

Zoster disease and herpes are two different entities. Both, however, show similarities with a third virus disease, namely varicella. The etiology of zoster is still debatable. According to Feyrter, capillitis and arteritis are two important features of this disease. Two cases of zoster ophthalmicus are reported and the histopathologic eye findings are described in detail. Disturbances of sensitivity, pupillary motility, and black corneal precipitates can be explained by severe neuritis of numerous nerve trunks, and by circumscribed detachment or destruction of the pigment epithelium of the iris. Extensive necrosis of the anterior uvea, cornea, or sclera can be observed in addition to the above mentioned findings and depend on the severity of the disease. The periarteritis nodosa and capillitis of zoster are the cause of the latter complications which can precipitate severe inflammatory conditions of the eye, even after the skin eruptions have subsided. The vascular disease may also cause malacia of the optic nerve. This leads to visual disturbances and disc changes. Zosteric tarsitis is the cause for lid edema. Disturbances of ocular motility have also been described and are most likely due to zosteric myositis of the extraocular muscles. (19 figures, 40 references)

Gunter K. von Noorden.

Kurihara, H. **Some properties of adenovirus type 8.** Acta Soc. Ophth. Japan **63**: 412-431, Feb., 1959.

This is a study of adenovirus type 8 in HeLa cell culture. The TC-titer of the virus varies with the degree of cell degeneration. The TC-titer increases definitely during storage of the culture at −8°C for one week and by a condensation of the cell before storage at −8°C, an enormous increase in TC-titer is obtained. The virus is inactivated in one minute at 55°C. The virus in liquid form is inactivated in three months at 37° C. At room temperature, however, the virus can be preserved in liquid form for one year with only a slight loss of titer. (4 figures, 12 tables, 18 references) Yukihiko Mitsui.

Laffers, Z. and Bozsoky, F. **The clinical significance of the antistreptolysin titer of the aqueous.** Ophthalmologica **137**:322-334, May, 1959.

The purpose of this study was to determine whether the antistreptolysin that had been identified in the aqueous by previous investigators was hematogenous or of local, ocular origin. In 29 cases of uveitis and five cases of eye diseases other than uveitis, aqueous and blood samples were drawn and compared with regard to their antistreptolysin titer. Besides, the protein content (Pandy reaction) and the cell count in the aqueous were determined to serve as indicators of the state of permeability of the blood-aqueous barrier.

The authors' results indicate 1. that the normal aqueous is free of antistreptolysin, 2. that in uveitis the antistreptolysin titer is largely dependent upon the permeability of the blood-aqueous barrier, that is, upon the severity of the inflammation irrespective of its etiology; and 3. that there is, in rare cases, local antibody formation which may produce higher aqueous titers than blood titers. Serial antistreptolysin determinations in aqueous and blood may be helpful in distinguishing between streptogenic and nonstreptogenic uveitis. (1 figure, 18 references) Peter C. Kronfeld.

Lieb, W. and Geeraets, W. J. **The effect of electromagnetic and corpuscular radiation on the eye.** Klin. Monatsbl. f. Augenh. **134**:769-796, 1959.

The significance of various types of radiation and their ocular effects is reviewed from the literature. The following rays are extensively discussed in regard to the eye: radar, radio, infrared, visible light, ultraviolet, ultrasonic, electric current, biologic radiation, and nuclear explosion.

Ultraviolet and ionizing rays affect primarily the cornea and conjunctiva. Under certain conditions infrared and electric currents can produce cataracts. The cataractogenic effect of ultraviolet does not appear to be clearly established. Retinal changes induced by infrared, visible light, and ionizing radiation have been described. Radar and radio waves do not seem to affect the eye. The problem of eye injuries and their prevention in nuclear laboratories and radiation institutes, as well as ocular damage resulting from atomic explosion are considered. Electromagnetic radiation causes similar intraocular changes as electric currents and ultrasonic rays. The physical properties of corpuscular and electromagnetic rays are summarized in a table. (2 tables, 79 references)

Gunter K. von Noorden.

von Nordheim, R. E. **Experimental ocular tuberculosis.** Ophthalmologica **137**:442-443, June, 1959.

The response of the rabbit's eye to anterior chamber inoculation with tubercle bacilli is a useful method to determine their virulence. Human tubercle bacilli usually causes a violent iridocyclitis with complete destruction of the eye and, in some instances, general dissemination.

Inoculation of BCG into the anterior chamber is followed by a chronic iridocyclitis similar in its course and severity to human tuberculous uveitis. Privine in concentrations of 0.5 to 0.9 percent used topically seemed to have a beneficial effect on the BCG-induced uveitis.

Peter C. Kronfeld.

Pau, H. **The origin of the corneal leukocytes in experimental keratitis.** Ophthalmologica **137**:254-269, April, 1959.

The author presents evidence to the effect that the leukocytes or leukocyte-like cells which appear in the cornea of the rabbit in response to the intracorneal injection of serum of another species are, to a large extent, of local origin. Histologic examination of the cornea 12 to 48 hours after the injection reveals, in the area of

the macroscopic corneal infiltrate, innumerable small basophilic particles out of which the nuclei of a good many of the inflammatory cells are formed. Even the cells that migrate from the limbus toward the site of injection are largely of local origin, that is derived from cells of the limbic region other than the regular constituents of the circulating blood. (20 figures, 16 references)

Peter C. Kronfeld.

Scardoni, C. and Mulargia, A. **Paraallergic phenomena.** Rassegna ital. d'ottal. 28:102-111, March-April, 1959.

It was possible to produce allergic reactions to specific toxins in rabbits. Such diseases as scleritis, episcleritis, sclerosing scleritis, phlyctenular keratoconjunctivitis and sympathetic ophthalmia reacted to small doses of vaccine and tuberculin. A further report on this difficult and uncertain field is promised. E. M. Blake.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Babel, J. and Ziv, B. **The effect of experimental hyper- and hypoglycemia upon the electroretinogram of the rabbit.** Ophthalmologica 137:270-281, April, 1959.

Serial electroretinograms (ERG) were taken on conscious, topically anesthetized rabbits while their carbohydrate metabolism was acutely altered by alloxan, dithizone or insulin. Diminution of the b-wave of the ERG was observed in close relationship with experimental hypoglycemia. Hyperglycemia had no demonstrable effect on the ERG. (6 figures, 10 references) Peter C. Kronfeld.

Cole, D. F. **Some effects of decreased plasma sodium concentration on the composition and tension of the aqueous humor.** Brit. J. Ophth. 43:268-287, May, 1959.

The direct relationship between the intraocular pressure and the osmotic concentration of the plasma is the subject of this study wherein the eye pressure is measured when plasma sodium concentration in the body is changed by various methods. Both the sodium concentration and the osmolarity of the plasma were decreased in some rabbits, whereas in others the osmolarity was kept constant. Intravenous infusions were done with and without nephremphraxis.

The results indicated that when the plasma sodium was reduced without reducing the osmolarity of the plasma, the ion concentrations in the aqueous remained the same though the intraocular pressure was reduced. When both sodium and osmolarity were reduced, then the aqueous ion concentration was also reduced and the intraocular pressure was increased. It is suggested that water enters the eye sufficiently rapidly to keep the aqueous approximately iso-osmotic with the plasma and the transport of solute into the posterior chamber is unaffected by reducing the concentration of sodium in the plasma. (37 references)

Morris Kaplan.

D'Esposito, M. **Variations of metabolism of the retina compared to the ciliary body after treatment with acetazolamide.** Arch. di ottal. 63:65-74, 1959

In a series of rabbits the oxygen consumption of the retina and of the ciliary body was determined in one eye. After intravenous Diamox, the other eye was tested. Statistical analysis of the results showed that Diamox decreased the oxygen consumption 11 percent. However, after administration of $NaHCO_3$, no difference could be found. Anaerobic glycolysis of the retina was 10 percent greater after Diamox and 29 percent less in the ciliary body.

The evidence indicated that Diamox decreases aqueous production by slowing the metabolism with an increase of lactic

acid in the aqueous formed. (4 tables, 26 references) Paul W. Miles.

De Vincentiis, M. and DeGennaro, G. **The effect of methyl-bis (beta-chloroethyl)-amine upon the metabolism of the retina.** Ophthalmologica **137**:384-389, June, 1959.

Methyl-bis (beta-chloroethyl)-amine is a nitrogen mustard which is used as a cytotoxic, palliative agent in the treatment of leukemias and of bronchogenic carcinoma. In concentrations of 5 gammas per ml. the drug depresses the anaerobic glycolysis of the retina of the rabbit. (1 tables, 14 references) Peter C. Kronfeld.

Giuffrè, Vincenzo. **The Effect of Meprobamate on visual fields and light sense.** Gior. ital. oftal. **10**:324-332, July-Aug., 1957.

Ingestion of Meprobamate by mouth did not affect the light sense but caused a concentric restriction of the visual fields, more marked in the temporal sectors. The author believes that the effect on the fields is due to altered impulses reaching the retina from the thalamus. (2 figures, 20 references) V. Tabone.

Kamei, T. **Glycogen content of the eye.** Acta Soc. Ophth. Japan **63**:934-940, April, 1959.

Kamei describes the results of glycogen determinations in the cornea and lens of man and some animals. The animals used are frog, carp, guinea pig, rat, domestic fowl, pigeon, rabbit, dog, cat, and cattle. The glycogen content of the cornea does not differ greatly in the various animals and it is in the range of 0.11 and 0.21 mg. percent. The glycogen content of the lens, however, differs greatly in these animals. The lens of frog and pigeon contains the greatest amount of glycogen. The nucleus of the pigeon lens contains nearly 10^4 times as much glycogen as the other animals. In general the glycogen content increases according to the portion of the lens in the following order: capsule, cortex and nucleus. There are two types of glycogen in the lens; the one is "free glycogen" which can be extracted by acid, and another is "fixed glycogen" which can be extracted by alkali. (4 figures, 4 tables, 22 references) Yukihiko Mitsui.

Kaufman, H. E. and Caldwell, L. A. **Pharmacological studies of pyrimethamine (Daraprim) in man.** A.M.A. Arch. Ophth. **61**:885-890, June, 1959.

Serum concentrations of pyrimethamine were determined in 19 patients being treated with various dosage schedules. Unless an initial "loading dose" was given, the serum concentration was found to rise very slowly and it required two weeks or more for the attainment of high stable serum drug levels. The authors recommend a regimen of 100 mg. of pyrimethamine given twice the first day, with 25 mg. given twice a day thereafter, and 1 gm. of trisulfapyrimidines given four times a day. With this dosage stable high drug levels were attained in the serum approximately two weeks earlier than when no loading dose was given. The authors also studied eight patients with bone marrow toxicity and in all of these the serum level of pyrimethamine was significantly higher than in those without bone marrow toxicity. (3 figures, 17 references) W. S. Hagler.

Kessler, J. **The capacity of the outflow channels and the volume of the anterior chamber.** A.M.A. Arch. Ophth. **61**:939-940, June, 1959.

The factors concerned with the relationship between the capacity of the outflow channels and the volume of the anterior chamber are briefly discussed. (4 references) W. S. Hagler.

Orlowski, W. C. and Wekka, Z. **The effect of alkali burns of the cornea on the**

pH of the aqueous. Ophthalmologica **137**: 244-253, April, 1959.

Alkali burns were produced by a three-step procedure, namely 1. local anesthesia with 5 percent cocaine, 2. instillation of three drops of N–NaOH, followed one to five minutes later by 3. copious irrigation of the conjunctival sac with normal saline solution. Aqueous samples were drawn at intervals from one to 90 minutes following the experimental burn. The pH determinations were made spectrophotometrically with phenol-red as indicator (under a layer of paraffin to avoid CO_2 loss).

There was a decided shift of the pH of the aqueous toward the alkaline side. This shift lasted about one and a half hours when only one minute had elapsed between the application of the alkali and its elimination from the conjunctival sac by irrigation; in the experiments with the five minute interval between the application of the alkali and the irrigation, the pH shift lasted three hours. (3 tables, 1 figure, 7 references) Peter C. Kronfeld.

Prijot, E. and Weekers, R. **The rigidity of the normal human eye.** Ophthalmologica **138**:1-9, July, 1959.

The ocular rigidity, that is the factor K in Friedenwald's formula relating intraocular fluid volume and intraocular pressure, $\frac{\log P_2}{\log P_1} = K \times V$, was measured by the authors, in vivo and in situ on two normal human eyes just before orbital exenterations necessitated by orbital tumors. Two cannulas were placed into the anterior chamber. Through one cannula accurately-measured amounts of fluid were injected into the chamber. The other cannula was connected with a transducer and a manometric calibrating device. The intraocular pressure variations were converted, by the transducer, into electric signals which, in turn, were amplified and recorded on a moving paper strip. The cannulation was made without disturbing the prevailing intraocular pressure and intraocular fluid volume. The measurements were made in successive steps of 10 cubic millimeters each which were injected fairly rapidly about every 50 to 60 seconds. In this manner the intraocular pressure was raised, in about 15 steps and in about 7 minutes, from 16 to 65 mm. of mercury.

In the two eyes tested in this manner. the coefficient of ocular rigidity proved to be practically constant and independent of the absolute intraocular pressure. Thus the authors confirmed Friedenwald's concept of the invariability of the ocular rigidity with varying pressure.

The authors also availed themselves of the opportunity of comparing, on the two normal human eyes destined to be removed together with the orbital contents, the results of ocular rigidity estimates by the direct intracameral injection method, on the one hand, and by the indirect, clinical method of differential tonometry on the other. They found a consistent difference between the results of the two methods, the injection method yielding the lower estimates. This discrepancy suggests that Friedenwald's estimation of the fluid volume displayed by the application of the tonometer is too low and that in addition to the corneal indentation and the stretching of the entire eyeball wall, the region around the posterior pole of the eyeball is deformed selectively during the tonometry. (3 tables, 4 figures, 20 references) Peter C. Kronfeld.

Rende, Salvatore. **Prednisolone in ophthalmology.** Gior. ital. oftal. **10**:508-515, Nov.-Dec., 1957.

The effect of cortisone and prednisolone was compared in 42 patients with diseased eyes. The two drugs were both effective in equal degree in their anti-inflammatory and analgesic action. Pred-

nisolone, however, acted more quickly and showed a wider spectrum. (1 table, 9 references) V. Tabone.

Salmony, D. **Chymotrypsin and zonulysis.** Brit. J. Ophth. **43**:321-324, June, 1959.

Aromatic amino acids are liberated from the proteins in the aqueous, vitreous, and lens after incubation with alpha-chymotrypsin. Its action is not specific for the zonule. The elements of surface area, time, and exposure may be the factors that restrict its action to the zonule. (2 references, 1 table, 1 figure) Irwin E. Gaynon.

Taki, T. **Histopathological changes of retina, optic nerve and arachnoidal membrane by methanol poisoning in mice.** Acta. Soc. Ophth. Japan **63**:484-508, Feb., 1959.

One injection of 5 ml. of methanol intraperitoneally had little effect on the eyes of mice. Repeated injections every other day showed a definite effect. The effect appears early in mice fed a vitamin B_1 deficient diet. The first change appears in the prechiasmatic portion of the arachnoid. The changes are hyperemia and exudation into the subarachnoid space. Later Marchi degeneration occurs in the optic nerve and retinal ganglion cells. (18 figures, 9 tables, 70 references) Yukihiko Mitsui.

Tiberi, G. F. **Nicotinic acid associated with isoniazid in the treatment of experimental ocular tuberculosis.** Boll. d'ocul. **37**:668-674, Sept., 1958.

The author found that the addition of nicotinic acid to isoniazid did not have a synergistic effect in the treatment of experimental ocular tuberculosis. (3 figures, 6 references) Joseph E. Alfano.

Uchida, Y. **Tissue culture of the corneal epithelium and endothelium of rabbits.** Acta. Soc. Ophth. Japan **63**:468-476, Feb., 1959.

The corneal epithelium and endothelium of rabbits were cultivated by means of the roller tube technique. The maintenance medium was Hank's solution with 20 percent horse serum and extract of chick embryo added. Uchida was able to obtain a "pure culture" of the epithelium. A subculture was not possible, however. The epithelial cells sometimes showed a monolayered and sometimes a multilayered development. The cells were spindle-shaped. The endothelial cells also showed a similar morphology. (20 figures, 17 references) Yukihiko Mitsui.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Boles Carenini, Bruno. **Effect of increased intraocular pressure on Haidinger's phenomenon.** Gior. ital. oftal. **10**:447-454, Nov.-Dec., 1957.

By increasing the tension of one eye by means of a dynamometer, the luminosity threshold and the threshold for the production of Haidinger's phenomenon were increased in the eye subjected to pressure and in the contralateral eye. A vascular mechanism is postulated. (4 tables, 19 references) V. Tabone.

Delogu, A. **Changes in the luminosity sense due to pulmonary disease and chronic anoxia.** Arch. di ottal. **63**:163-177, March-April, 1959.

Reports have shown an effect of induced anoxia on the visual field in glaucoma. Normal angioscotomas can also be affected by anoxia. However, there was no consistent deviation from normal of the luminosity curves in 14 subjects with chronic anoxia of pulmonary origin. The degree of anoxia was documented by blood studies in each case. (1 table, 15 charts, 25 references) Paul W. Miles.

D'Esposito, M. **Review of a method of examination and the results of treatment**

of anomalous correspondence and extrafoveal fixation. Arch. di ottal. **63**:119-142, March-April, 1959.

Treatment of anomalous correspondence is difficult because of poor cooperation at the age best suited for training. The expense is high and many people cannot afford it. A series of 200 patients were treated by occlusion, surgery, orthoptics (Cuppers euthoscope, major amblyoscope), proprioceptive reorganization, a monocular stimulation to stimulate the amblyopic macula and gradually reduce the angle of anomaly, and by one second alternation at the objective angle with the synoptophore.

Of the 200 patients 57 had anomalous correspondence. Results showed no improvement in 33, normal fusion but poor central acuity in 20, and normal fusion with good vision in four.

The Cuppers after-image method of treatment is recommended in patients between the ages of five and 20 years. (1 figure, 1 table, 73 references)

Paul W. Miles.

Friede, R. **A modified cyclodialysis and its use in the treatment of juvenile progressive malignant myopia.** Ophthalmologica **137**:282-285, April, 1959.

The author advocates a slightly angular scleral incision, the angle of approximately 150° opening toward the limbus. Thus a short limbus-based scleral flap is made which offers better uveal exposure than the conventional limbus-parallel incision. The ciliary body is at first dialyzed by straight (meridional) strokes with a spatula with a baseball-bat-like tip. The cyclodialysis is then completed by sweeps in the inverted direction (from the suprachoroidal space into the anterior chamber). The entire temporal half of the ciliary body is separated from the sclera in this manner. Blood is removed from the anterior chamber and the suprachoroidal space by suction. The scleral flap may be sutured back into place.

The number of cases operated upon by this method "is considerable." No "disadvantages" of the greater width of the dialysis have been observed. "Hypotony, lasting several months is common but does not entail any untoward consequences." The author has used this method in chronic simple glaucoma as well as in cases of progressive degenerative myopia. "The progression of the latter disease is halted by the operation and the vision becomes stationary." (2 figures)

Peter C. Kronfeld.

Heinsius, E. **On the different forms of trichromatism and the border between normal and defective color perception.** Klin. Monatsbl. f. Augenh. **135**:95-107, 1959.

A survey of the various types of trichromatism is presented. Reference is made to less known cases ranging between absolute trichromatism and the anomalous form of this condition. A table demonstrates the results obtained with an anomaloscope and the pigment color test. The different forms of comparatively normal trichromates, color amblyopia, and color asthenopia are defined. The mode of behavior of patients with pigment color anomalies is exemplified by observations of others as well as by those of the author himself. (1 table, 13 references)

Gunter K. von Noorden.

Jonkers, G. H. **What is to be expected from amblyopia treatment?** Ophthalmologica **137**:365-371, June, 1959.

This report from the Orthoptic Institute in Gorinchem (Holland) concerns itself with the over-all results of the treatment of amblyopia associated with strabismus. In the material of this institute amblyopia of serious degree (visual acuity of less than 20/200) occurred in 46.1 percent of the cases of esotropia. Amblyopia

associated with fixed eccentric fixation (as reported previously by the author) resisted any form of treatment. In cases in which the eccentric fixation point shifted measurably during the early part of the treatment the prognosis was much more favorable.

For the evaluation of the results of the treatment a series of 171 cases of esotropia were broken down into groups according to the duration of the strabismus before treatment was started. For each of these groups the mean visual acuity before and after one year of treatment was calculated. Expressed in terms of these means the improvement in visual acuity attributable to the treatment was independent of the duration of the strabismus prior to treatment. In other words, the mean improvement in acuity for each group did not vary as a function of the duration of the strabismus prior to treatment.

The means for each group as well as the over-all means also showed that, statistically, the result of amblyopia therapy falls very considerably short of the ideal goal, that is normal visual acuity. The over-all pretreatment mean acuity was 0.17; the over-all mean improvement was 0.37 which placed the over-all mean post-treatment visual acuity at about 0.54. Despite this imperfect result, the author strongly recommends amblyopia therapy except in cases of invariable eccentric fixation.

For a series of 260 cases of unilateral convergent strabismus the mean refraction of the fixating and the squinting eye were calculated and compared with the mean refraction of normal, nonsquinting eyes of the same age (Brown and Slapeter). The slight increase in hyperopia from the age of three years to the age of eight years (first reported by E. V. L. Brown) also occurred in Jonkers' series. The mean refraction of the squinting eye differed by only a half of a diopter of hyperopia from the mean refraction of their fixating mates. The author concludes that "the state of refraction has little to do with the genesis of estropia." (1 figure, 5 tables, 6 references) Peter C. Kronfeld.

Kylstra, J. **Autokinesia.** Ophthalmologica **137**:402-408, June, 1959.

The term autokinesia (or autokinetic illusion) applies to the phenomenon of apparent movement of a fixed spot of light in a dark environment. First described by Charpentier in 1886, the phenomenon has been the subject of numerous, more or less academic studies by physiologists and psychologists. The problems of orientation and disorientation in the air that have come up since flying has become a common mode of transportation, have revived interest in autokinesia.

The author has designed an apparatus for the graphic recording of the phenomenon and has made such recordings on a number of healthy young men, some with and some without flying experience, and also on a few older pilots with thousands of flying hours to their credit. The effect of different experimental conditions upon the phenomenon was studied, such as the presence of a second light, monocular versus binocular observation, vestibular stimulation and other factors. As a result of these studies, the author believes that autokinesia can become a cause of errors of orientation during night flying. A pilot coming out of a low overcast at night may observe "a single light such as a light house or a tail light of his leader in formation flying, and build up an incorrect picture of his orientation in space." (7 references) Peter C. Kronfeld.

Linksz, Arthur. **Optics and visual physiology; annual review.** A.M.A. Arch. Ophth. **61**:944-1003, June, 1959.

The author reviews and discusses 289 articles concerning optics and visual physiology published during 1958. (289 references) M. S. Hagler.

Maggi, Carlo. **Classification of amblyopia.** Brit. J. Ophth. **43**:345-360, June, 1959.

The arrest of macular function is the basis of amblyopia treatment. The retinal correspondence is an indication of the spatial relationship between macula and the cortex. Fixation is always central if the retinal correspondence is normal. A classification of amblyopia based on the diagnosis of the type of retinal correspondence with the use of the after-image test, synoptaphore, visuscope and treatment with the euthyscope is given. The development of high grade amblyopia is based on the onset, the angle of deviation, duration of the deviation and the length of treatment.

The treatment of amblyopia is based on the reversal of the inhibition seen in the normal retinoceptogram, and the reestablishmnet of the normal retinal correspondence. (2 figures, 2 tables, 2 references) Irwin E. Gaynon.

Mayweg, S. and Massie, H. H. **Abnormal retinal correspondence. A preliminary report on the treatment of abnormal retinal correspondence by Cuppers' after-image method.** Brit. J. Ophth. **43**:293-301, May, 1959.

One of the more recent treatments for abnormal retinal correspondence is that described by Cuppers and is based on the Bielschowsky after-image test. After treatment, by orthoptics to improve the vision of the deviating eye and to be certain that the fixation is central in each eye, treatment was continued on a major synoptophore by the after-image test; 22 patients were followed three to five months after completion of treatment. Four of these patients developed normal retinal correspondence. The results of the treatment in each case is described in some detail. (13 references)

Morris Kaplan.

5

DIAGNOSIS AND THERAPY

Denier van der Gon, J. J. **Practical use of the pinhole.** Ophthalmologica **137**:414-415, June, 1959.

In order to use the pinhole most effectively for the recognition of visual impairment due to opacities of the media or errors of refraction, it is important that the test objects, that is the optotypes, are well illuminated and that the size of the pinhole is such that diffraction phenomena are not too disturbing. For patients with incipient cataract it may be advisable to increase the illumination of the optotypes up to 5,000 lux. A pinhole of one-millimeter diameter is best suited for most cases. The visual acuity of the normal eye taken through a 0.3-milimeter pinhole is about 20/60; it increases to 20/20 or slightly better as the pinhole is enlarged to a one-millimeter aperture. Further increase in the size of the pinhole causes very little change in visual acuity. In a patient with incipient cataracts a one-millimeter pinhole may improve the visual acuity from 20/200 to 20/40. Making the pinhole smaller should decrease the visual acuity just like in the normal eye. The use of pinholes of different sizes makes the diagnosis of a normal macula, invisible on account of lens opacities, more definite. (1 figure) Peter C. Kronfeld.

Georgiade, N. Wolf, R., Richard, F. and Pickrell, K. **Use of bovine bone in reconstructive surgery.** Plast. & Reconstruct. Surg. **24**:13-18, July, 1959.

Solid bovine implants have given uniformly successful results with minimal reaction. One case is shown with pictures of the reconstruction of the lower rim of the orbit after injury which caused the loss of the eye. Two cases are shown in which this material was used for reconstruction of the mandible. The author suggests that even though all of his pa-

tients have had satisfactory results, a larger series of patients must be studied before this material can be recommended for general use in reconstructive surgery.

Alston Callahan.

Glees, M. **Experiences with thrombocid in thrombosis of the central retinal vein.** Klin. Monatsbl. f. Augenh. **134**:807-812, 1959.

A group of 18 patients was treated with thrombocid (an anticoagulant) using a dosage recommended by Mylius and Witt. A similar group with central vein thrombosis did not receive anticoagulants. Comparison of the two groups revealed that the use of thrombocid did not result in a more favorable outcome. In fact, side effects such as mental confusion in one case and loss of hair in three cases were observed, and emphasize the importance of caution and critical consideration when using this drug. (1 figure, 1 table, 15 references)

Gunter K. von Noorden.

Horsten, G. M. P., Hoette, H. H. A. and Winkelman, J. E. **A technique of electroretinography.** Ophthalmologica **137**: 416-419, June, 1959.

The authors' method may be described as serial electroretinography during a controlled dark adaptation test. The adaptometer of Goldman and Weekers was modified so that the hemisphere used for preadaptation also serves as a stimulus for electroretinography. Preadaptation is accomplished by exposure to 3,000 lux for 10 minutes. Fixation of a central dim red light is maintained throughout the test. Serial ERG's in response to flashes of 50 lux intensity and 1/10 second duration are taken every half minute during the first 10 minutes and every two minutes during the next 20 minutes. The whole test takes 40 minutes.

Ten control individuals showed very considerable variations "too great to calculate a mean curve." A marked increase in both the a- and the b-potential were observed. This increase took place during the first 20 minutes of dark adaptation. In one patient with, probably, congenital night blindness the a-potential increased to about the same extent as in a normal control, while the b-potential increased only very slightly.

This work, like many other current studies, is an attempt to standardize electroretinography and to make it more useful in clinical ophthalmology. (1 figure)

Peter C. Kronfeld.

Jacobson, J. H. and Gestring, G. F. **Prevention of ocular trauma during electro-retinography.** A.M.A. Arch. Ophth. **61**:941-942, June, 1959.

In order to prevent corneal burns due to electrical energy from the recording device, the authors strongly recommend the insertion of a 2 ma. fuse between the patient and the amplifier input box. This fuse will burn out upon the occurrence of any current which might possibly cause damage to the patient. They urge the incorporation of this fuse into the circuit for all electroretinography and electromyography. (3 figures)

W. S. Hagler.

Johnson, P. A. **Sarcoidosis and swellings on the nose and late ocular sequelae.** Brit J. Ophth. **43**:376-377, June, 1959.

A case of sarcoidosis involving the lungs, forehead and bridge of the nose is reported. After 11 weeks the swellings subsided and mutton fat precipitates of the cornea were noted. (1 figure)

Irwin E. Gaynon.

Kittel, V. **The problem of tonometer sterilization.** Klin. Monatsbl. f. Augenh. **134**:818-824, 1959.

The commonly practiced cleansing of the footplate with an ether sponge does

not prevent transmission of bacterial and viral diseases. Experiments by the author revealed that heating of the footplate and the plunger in an alcohol flame reduced bacterial and possibly even viral transmission to a considerable degree. The flaming method is superior to ether sponging and does not damage the precision of the instrument. (4 tables, 3 references) Gunter K. von Noorden.

Liesenfeld, H. **The history of fundus photography.** Ophthalmologica **137**:390-398, June, 1959.

The development of fundus photography is traced, in brief and not too technical language, from the cameras of Dimmer, Thorner and Wolf (1905 to 1910) to the most recent camera by Noyori. The author is working on a combination of the Minox camera with a German electric ophthalmoscope and a built-in electronic flash. (3 figures, 30 references)
Peter C. Kronfeld.

von Nordheim, R. E. **Treatment of inflammatory processes in ophthalmology by vasoconstriction.** Ophthalmologica **137**:444-446, June, 1959.

In various clinical conditions the author has observed beneficial effects of topical applications of the vasoconstrictor Privine in concentrations of 0.5 to 0.9 percent. (8 references) Peter C. Kronfeld.

Plattner, H. **A simple technique for elimination of eye movements during the production of an afterimage with the euthyscope.** Klin. Monatsbl. f. Augenh. **135**:107-110, 1959.

The patient observes a fixation mark with his sound eye while the euthyscope is applied to the other eye. The mark is projected on a screen lateral to the patient and observed by him in a mirror which is held directly in front of the eye. By tilting the mirror, the eye can be directed and fixed in any desirable direction while the other remains steady in a position convenient for euthyscopy. (2 references)
Gunter K. von Noorden.

Schirmer, R. **Supplement of local chloramphenicol therapy in external diseases of the eye.** Klin. Monatsbl. f. Augenh. **135**: 110-112, 1959.

A report is given on the effectiveness of a leukomycin solution. Its advantage over chloramphenicol lies in its higher water solubility. The drug was evaluated in 80 patients with various external diseases. Only 20 percent of this group showed little response to treatment, the others responded well. It is suggested that treatment with leukomycin drops in daytime be supported by application of leukomycin ointment during the night.
Gunter K. von Noorden.

Steinvorth, E. and Hotte, E. **Photography of the chamber angle with the Minox camera.** Klin. Monatsbl. f. Augenh. **135**:112-113, 1959.

Satisfactory results were obtained with the Minox camera which was used in connection with a gonioscope mounted on a Zeiss slitlamp. The slit beam served as a sufficient light source for photography of the gonioscopic view. (2 figures, 1 reference) Gunter K. von Noorden.

Uhl, H. **Therapy with placental extracts in ophthalmology.** Klin. Monatsbl f. Augenh. **135**:118-121, 1959.

A commercial placental preparation was injected retrobulbarly or subconjunctivally, or used as an ointment. The author reports subjective and clinical improvement particularly in younger persons with high myopia or macular degeneration. (5 references) Gunter K. von Noorden.

Vannini, A. **Thromboelastografy in the study of human pathological aqueous.**

Rassegna ital. d'ottal. **28**:12-32, Jan.-Feb., 1959.

A very full review is given of the studies of the coagulation of substances in the aqueous which have been recognized by other observers. Vannini has developed a method of recording the coagulation of the fibrin in the presence of cataract, hyphema, cyclitis and trauma. Pathologic changes are amplified by the tracing method which helps in the understanding of the characteristics of the fibrin filaments. (9 figures) E. M. Blake.

Winkelman, J. E. **Histologic findings after experimental electrocoagulation.** Ophthalmologica **137**:408-413, June, 1959.

This study was prompted by a change for the worse in the results of detachment operations when two old diathermy machines used in the author's clinic in Amsterdam were replaced by a new one. The worsening of the operative results was associated with ominous star-shaped retinal folds. The author's technique consists of "generous" surface diathermy followed by a posterior sclerotomy for drainage made with a keratome.

With the new machine experimental surface coagulations were made in rabbits at ammeter settings of 8 and 10 milliamperes. Three weeks later the eyes were enucleated and examined histologically. The effect of the coagulations with the weaker current was satisfactory and the only slightly stronger current produced a "disastrous" result: "Retina and choroid were completely destroyed; only an extremely narrow external margin of sclera was preserved and from this margin connective tissue seemed to grow into the vitreous." Further experimental coagulations were made with the new machine at different intensities and the effects were studied histologically at intervals ranging from two hours to 14 days. In many of the sections accumulations of "cells of the vitreous body" (Hamburg) could be seen between vitreous and the internal limiting membrane in the area of the coagulation. In one rabbit these cells gave rise to the formation of the preretinal membrane. Such a preretinal membrane could, in the human eye, give rise to stellate retinal folds.

Investigation of the new machine (make not stated) in the laboratory of Medical Physics of the University of Amsterdam revealed its output to be a current of high frequency. (0.5 × 10 per sec.) with tissue effects that were difficult to control. Currents of lower frequency were much easier to regulate. Such a machine has proved very satisfactory in clinical use.

Peter C. Kronfeld.

6

OCULAR MOTILITY

Ohm, J. **"Amplitudinal sign" in miners' nystagmus and spasmus nutans.** Klin. Monatsbl. f. Augenh. **135**:91-95, 1959.

Increase of the amplitude of nystagmus has been observed in five miners and a child with spasmus nutans. A theory is discussed which links this phenomenon with spontaneous, binocular innervation of divergence. The "amplitudinal sign" is explained by the fact that divergence innervation coincides with the lateral movement of one eye, thus intensifying its amplitude of nystagmus, while inward movement of the fellow eye reduces its amplitude. (6 references)

Gunter K. von Noorden.

Pasino, L., Pagni, C. A. and Cordella, M. **Behavior of fixation in strabismus and anisometropic amblyopia.** Rassegna ital. d'ottal. **28**:57-61, Jan.-Feb., 1959.

The results of the authors investigation confirm the findings of Mackensen. Electrographic studies give evidence of notable disturbance of monocular fixation. In all cases of the amblyopia of strabismus there is disturbance of fixation of the amblyopic eye, although this is not always evident

clinically. Sensory incoordination lies at the basis of the incoordination of strabismus. E. M. Blake.

Sobanski, J., Skwiarczynska, J., and others. **On concomitant strabismus and its treatment.** Ophthalmologica **137**:225-233, April, 1959.

A series of 1,330 case of concomitant strabismus, treated in a special motility clinic of the University of Lodz (Poland) is presented in tabular farm. The usual methods were employed to make the two eyes equal or close to equal in terms of visual acuity and image size. This having been accomplished, atropine was used topically in both eyes in esotropia (and pilocarpine in exotropia) in order to alter the innervation of the horizontal muscles in the direction of parallelism for distance. Failure of these conservative measures was interpreted as a sign of organic alterations in the muscles concerned and as an indication for muscle surgery. Parellelism for distance was accomplished in a remarkably large percentage of the cases of esotropia in which the "doctor's orders were observed to the letter." (6 tables, 3 references) Peter C. Kronfeld.

7

CONJUNCTIVA, CORNEA, SCLERA

Agarwal, R. C. **Acute metastatic corneal abscess.** Ophthalmologica **137**:239-243, April, 1959.

Two bilateral and one unilateral case of acute, deep and seemingly suppurative keratitis are reported. The disease resembled deep pustuliform keratitis but the etiologic workup revealed only severe peridontal infection in two cases and smallpox immediately prior to the eye infection in the third. All three patients were treated with daily subconjunctival injections of penicillin and retrobulbar injections of hyaluronidase with priscoline. The end result was favorable in two of the five affected eyes. (1 table, 10 references) Peter C. Kronfeld.

Bozzoni, F. **A case of ligneous conjunctivitis.** Boll. d'ocul. **37**:645-653, Sept., 1958.

The author reviews the literature and presents a case of ligneous conjunctivitis, occurring in a child of eight months of age. The patient was observed for a period of two and one-half years. During this time, even under various forms of therapy, the pseudomembranes failed to disappear. In contrast to the major number of cases described in the literature, the cornea never became affected. (1 table, 3 figures, 42 references) Joseph E. Alfano.

Leffertstra, L. J. **Acute keratoconnus complicating Mongoloid idiocy.** Ophthalmologica **137**:432-435, June, 1959.

A 10-year-old female Mongoloid idiot with bilateral keratoconnus developed acute hydrops of the cornea in the left eye and, seven weeks later, in the right eye. Under conservative treatment the acute condition subsided in each eye with only slight permanent scarring. The German term, "Kammerwasser-Einbruch" (aqueous suddenly breaking into the cornea) is considered most appropriate for this condition which in many instances has been treated by corneal transplantation.

Possible relationships between mental deficiency and keratoconnus are discussed. (8 figures, 9 references) Peter C. Kronfeld.

Methur, S. P. **Epidermoid carcinoma of the conjunctiva.**. Ophthalmologica **137**: 320-321, May, 1959.

A 17-year-old male presented a gray, keratinized growth, 2.5 by 2.5 mm. in size, arising from a pterygium. Histologically the tumor was found to be an epidermoid carcinoma of grade I. No follow-up examination is recorded. (2 references) Peter C. Kronfeld.

Miron, M. S., Pascu, M. and Stoicanu, N. **Tuberculids of the conjunctiva.** Ophthalmologica **137**:306-312, May, 1959.

One three-year-old and one four-year-old child presented, in almost identical form, an eye condition characterized by small episcleral, yellowish-red nodules with no or minimal transient conjunctivitis and no minimal subjective symptoms. The nodules were absorbed in about a month's time, leaving behind maroon- or violet-colored spots. Despite local therapy with mild mercurials and steroids, new nodules could be observed to form and to be absorbed again. The only additional positive findings were marked enlargement of the hilar shadows and positive skin reactions to tuberculin. On systemic treatment with hydrazide, vitamins and calcium, the condition cleared up entirely in one child. The authors classify the nodules as tuberculids. (1 figure, 12 references) Peter C. Kronfeld.

Pagani, L. S. **Sjögren syndrome in the male.** Rassegna ital. d'ottal. **28**:67-80, Jan.-Feb., 1959.

A man, 49 years of age, presented the classical picture of drying of the conjunctiva, opacification of the cornea and rheumatic joints. There was an absence of tears, atrophy of the mucous membranes of the nose and throat, and the urinary output was only one-half litre in 24 hours. Treatment with prednisolone for 20 days led to greatly improved mucous membranes. The disease is much more frequent in elderly women. E. M. Blake.

Pannarale, M. R. **Candida albicans infection following antibiotic therapy.** Boll. d'ocul. **37**:654-667, Sept., 1958.

The author reviews the literature pertaining to secondary ocular infections due to Candida albicans which follow antibiotic therapy and he reports a case of very severe keratoconjunctivitis. The case reported presents a severe necrotizing process in the cornea with pus in the anterior chamber. Ultimately there was severe corneal scarring. (3 figures, 37 references) Joseph E. Alfano.

Shinozuka, S. **Studies on the riboflavin metabolism in epidemic keratoconjunctivitis.** Acta Soc. Ophth. Japan **63**:682-696, March, 1959.

The basic condition of keratitis development by epidemic keratoconjunctivitis (EKC) was studied. The riboflavin concentration in the blood was determined in patients and controls by fluorophotometry. In the normal controls the concentration was $8.72 \pm 1.21\gamma$/dl on the average. In EKC patients with positive subepithelial punctate keratitis, the concentration was $5.27 \pm 0.52\gamma$/dl. In EKC patients without keratitis, the concentration was $8.70 \pm 1.91\gamma$/dl. The measurement in patients was performed in the early stage of keratitis development or a corresponding stage in cases of negative keratitis. Shinozaki considers that a deficiency in vitamin B_2 may have a role in the development of keratitis by EKC and he believes that an administration of this vitamin is beneficial in the treatment of this condition. (9 references, 3 tables, 40 references) Yukihiko Mitsui.

Strampelli, B. **A technique for the restoration of the conjunctival cul-de-sac.** Boll. d'ocul. **37**:682-691, Sept., 1958.

The author describes a technique for the restoration of the conjunctival cul-de-sac. After a separation of the lids a circular incision of the conjunctiva is made extending from the lacrimal caruncle to the external canthus. The incision is then carried horizontally as if one were performing an external canthotomy. The upper and lower lids are then everted by means of lid elevators the handles of which have been removed. The lids are then fixed in this position for three days. This procedure gives a central button of conjunctiva separated from the upper and lower conjunctival cul-de-sac. Mucous

membrane grafts are then inserted in the upper and lower conjunctival cul-de-sac. (12 figures) Joseph E. Alfano.

Tada, K. **A study of the tears in epidemic keratoconjunctivitis.** Acta Soc. Ophth. Japan **63**:725-745, March, 1959.

This is a study of changes in tear secretion by EKC. The normal average tear secretion is found to be 15.1 ± 2.2 mm. by the Schirmer method. The secretion considerably increases (sometimes over 26 mm.) during the first two weeks of EKC. After the fifth week, it decreases considerably. In some cases it becomes less than 5 mm. This decrease may be due to a disturbance of the lacrimal glands. (5 figures, 27 tables, 45 references)

Yukihiko Mitsui.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Cooper, A. C. **Postoperative choroidal detachment.** Ophthalmologica **137**:436-441, June, 1959.

The author observed choroidal detachment in 10 out of 206 consecutive cataract extractions and two out of 27 trephine operations. In all but two cases the restoration of the anterior chamber and the disappearance of the detachment ran a parallel course. If the choroidal detachment persisted the author drained the subcoroidal space by several ignipunctures with a thick short needle. "Whatever the mechanism of the development of choroidal detachment may be, the rapid and complete restoration (of normal conditions) following drainage of the subchoroidal fluid is a striking phenomenon. Apparently a vicious circle in the form of a disturbance in the intraocular relationships regarding pressure and fluid between the anterior chamber, the perichoroidal space, and the vitreous is interrupted by our interference (the ignipuncture)."

In the discussion the term spongiosis of the choroid or suprachoroid was suggested for the condition conventionally called choroidal detachment. Colenbrander reported satisfactory results with diamox. "A possible (free) fistula seems to close when no fluid passes through it." Hagedoorn also uses diamox in cases of postoperative flat chamber but "the results are not always good." Leffertstra reported a fatal case of acute agranulocytosis following the use of diamox (nine 250-gram tablets) for a persistently absent anterior chamber. Flieringa's routine for postoperative flat chamber is early ambulation and dismissal of the patient from the hospital.

In closing the discussion Copper stated that he practices early ambulation in all his postoperative cases, with or without choroidal detachment. Restoration of the anterior chamber with air or saline is not necessary if the drainage is done by means of several ignipunctures. (3 figures, 5 references) Peter C. Kronfeld.

Redi, R. **Diathermic treatment of injuries to the ciliary body.** Rassegna ital. d'ottal. **28**:44-56, Jan.-Feb., 1959.

In 84 patients with injury to the sclera and the ciliary body the eye was treated surgically. Local anesthesia was used in all patients except children. The scleral wound was closed with no. 6 silk, the scleral edges were treated with diathermy and the area was covered with conjunctiva. Antibiotic medication was carried on for some weeks. Eyes in which the wound contained fragments of stone or wood did not heal well. Final vision in 10 patients was 5/10, in 19 light projection and in 23 the globe was atrophied.

E. M. Blake.

Rossi, A. **Vascular destruction in diabetic rubeosis iridis.** Rassegna ital. d'ottal. **28**:91-98, March-April, 1959.

The study of numerous cases of rubeosis iridis gonioscopically has disclosed the presence of newformed vessels surround-

ing the pupil and coursing back to the root of the iris. Later these vessels develop in the walls of the angle with gradual increase of intraocular pressure. Goniosynecchia thus develop until there is complete closure of the angle and a post-rubeosis hemorrhagic glaucoma from vascular degeneration which affects not only the eye but the general arterial system.

E. M. Blake.

9

GLAUCOMA AND OCULAR TENSION

Cristini, G. and Dorello, U. **Experimental ocular hypertension.** Rassegna ital. d'ottal. :28:81-90, March-April, 1959.

The conjunctiva was incised about the cornea and freed halfway back to the equator where 10 to 50 diathermy coagulation points were made with a 50 milliampere electrode. The opposite eye was similarly treated except for the diathermy. Coagulation on the primary eye was repeated one or more times. This resulted in hypertension, attributed to changes in the choroid. Microscopic study of sections of the eye suggested that the hypertension was due to pressure on the uveal arterial vessels and to interstitial atrophy.

E. M. Blake.

Menna, F. **Dyscrinism and the diencephalon in pathogenesis of glaucoma and cataract.** Arch. di ottal. **63**:105-112, March-April, 1959.

A woman, 39 years of age, had a thyroidectomy followed by tetany which required parathormone. Two years later she developed intumescent cataracts and glaucoma with a tension of 35 in each eye. Tests showed myxedema, low blood calcium, 48 percent eosinophilia, and increased bleeding time. The glaucoma responded to Diamox. The cataracts were removed successfully, but the discs were found to be cupped. The possible endocrine or innervation factors in the etiology are discussed. (16 references)

Paul W. Miles.

Pagani, L. **Functional examination of the eye with hydrophthalmos.** Rassegna ital. d'ottal. **28**:112+, March-April, 1959.

Three degrees of hydrophthalmos are mentioned, a benign form, one relatively stable and one in which the anterior chamber is much reduced, the globe inflamed, and the cornea opaque. Careful and repeated examination of the eye, especially the field of vision, is urged. From all the functional tests very little can be deduced to indicate absolute specificity of this form of glaucoma which varies from a typical chronic form to such changes as high myopia and idiopathetic retinal dystrophy.

E. M. Blake.

Samuelly, C. **Glaucoma secondary to traumatic cataract.** Arch. di ottal. **63**:113-118, March-April, 1959.

Glaucoma secondary to traumatic cataract may be from pupil block, from hypersecretion by lens movement against the ciliary body in subluxation, from lens intumescence, or from products of disintegration which injure or block the filtration angle. Diamox and miotics often result in resorption of the lens cortex. Subluxated lenses should be removed.

Paul W. Miles.

10

CRYSTALLINE LENS

Cristine, G. **Congenital cataract in the galactose syndrome.** Rassegna ital. d'ottal. **28**:3-11, Jan.-Feb., 1959.

The presence of congenital cataract in a galactose syndrome must often be suspected, even if the cataract is the only noticeable clinical sign. The author records several cases of abortive galacto-

semia wherein the cataract was the only clinical sign and the diagnosis was made possible by the galactose tolerance test and the presence of hyperamino aciduria.
E. M. Blake.

Fecher, P. U. **Contribution to the technique of cataract extraction: description of a modern method practiced in India.** Ophthalmologica **137**:377-383, June, 1959.

Stationed at the Gandhi Eye Hospital in Aligarh, India, during the winter of 1956-57 the author became familiar with a method of cataract extraction, widely and successfully practiced in India but "not well known elsewhere." The essential features were 1. a small, limbus-based flap dissected well into the cornea, 2. one corneo-scleral suture, preplaced either by taking a scleral and a corneal bite or by passing the suture through a groove after de Mendoza, 3. keratone incision extended with Castroviejo scissors, 4. delivery of the lens by Elschnig's method of combined traction and external pressure, usually with the capsule forceps, but in intumescent cataract with the erisiphake, 5. closure of the wound by tying the preplaced suture and placing conjunctival sutures, 6. air injection into the anterior chamber, and 7. subconjunctival injection of penicillin.

Of particular importance, in the author's opinion, was the proper manipulation of the lid speculum by the assistant (1 figure, 6 references) Peter C. Kronfeld.

Fuchs, J. **Enzymatic zonulolysis by alpha-chymotrypsin in cataract surgery.** Klin. Monatsbl. f. Augenh. **135**:52-55, 1959.

Zonulolysis was employed during cataract surgery in 30 patients. This group consisted essentially of patients younger than 60 years with juvenile or immature cataracts. Forty-six patients served as a control group. These patients were generally older and zonulolysis was not employed. The eyes in which zonulolysis had been used were characterized by increased pigment content of the aqueous, delayed wound healing, increased pigmentation of the anterior vitreal surface, increased and prolonged wrinkling of Descemet's membrane (striate keratopathy), and more postoperative pain and irritation. In spite of these observations, zonulolysis presents a considerable progress in the field of cataract surgery, inasmuch as now juvenile cataracts can be extracted intracapsularly. Careful consideration should be given to the indication for this technique. Gunter K. von Noorden.

Garigali, F. and Bonaccorsi, A. **Chemical changes in the aqueous with senile cortical cataract.** Rassegna ital. d'ottal. Jan.-Feb., 1959.

Following the technique of Amsler the authors practiced puncture of the anterior chamber of eyes with cortical cataract, removing from one-fourth to one-half cc. of aqueous. The fluid was promptly examined in the laboratory and studied for the percentage of proteins, chlorides and glucose. Quite regularly the percentage of glucose and proteins was within the usual level but the amount of chlorides was moderately reduced. E. M. Blake.

Kleinert, H. **Treatment of vitreous prolapse during cataract surgery.** Klin. Momatsbl. f. Augenh. **135**:56-68, 1959.

Vitreous prolapse has been reported to occur in 3 to 10 percent of all cataract extractions. Considerable decrease of this percentage can be expected with the use of zonulolysis. Using the vitreous reposition technique of Castroviejo, the author was able to maintain a normal reacting round pupil in 14 out of 20 patients in whom prolapse occurred during surgery; in five of them distortion of the superior portion of the pupillary margin was caused

by peripheral anterior synechiae. In no case did sphincterotomy or corepraxy become necessary. (3 figures, 1 table, 7 references) Gunter K. von Noorden.

Kranning, H. D. **Analysis of corneal astigmatism following cataract surgery.** Klin. Monatsbl. f. Augenh. **135**:68-81 1959.

The etiology of increase of the horizontal and decrease of the vertical corneal curvature after cataract extraction is still a matter of controversy. Various theories are mentioned. The author performed 150 cataract extractions, in most cases without wound closure. The corneal curvature was determined postoperatively with a Zeiss ophthalmometer. Systematic differences in direction of axis and degree of astigmatism were found in certain groups. There was a difference in axis between the right and left eye when some surgeons operated. The reason for this was found in the dexterity of different surgeons who were right or left handed, variety of skill, and the slight handicap of one surgeon who had an injured hand. A high degree of astigmatism was present after operations complicated by vitreous prolapse and after intracapsular extractions. Age, sex, basal or complete iridectomy, or amount of postoperative wrinkling of Descemet's membrane were not related to the degree of postoperative astigmatism. (3 figures, 8 tables, 39 references) Gunter K. von Noorden.

Manschot, W. A. **Bilateral cataract extraction.** Ophthalmologica **137**:428-430, June, 1959.

On the basis of six bilateral cataract operations among cataract extraction on 80 consecutive patients, the author strongly recommends the bilateral procedure, his principal argument being the lesser physical and mental strain on the patient without a significantly greater risk.

Peter C. Kronfeld

11

RETINA AND VITREOUS

Delogu, A. **Retinopathy in the course of grave diffuse dermatomyositis.** Arch. di ottal. **63**:143-50, March-April, 1959.

This case report is apparently the sixth in the literature. Dermatomyositis is a collagen disease with a mortality rate of 55 percent which begins with fever, malaise and weakness lasting two or three months. There is pain in the large striated muscles followed by atrophy and erythema of skin and mucosa, there may be hemorrhagic retinopathy and ptosis.

The present case occurred in a man aged 22 years. The past history was negative except for bronchopheumonia and influenza. The dermatomyositis began with fever, headache, and a swollen left arm. The eyes showed bilateral papilledema, congested retinal veins, large and small hemorrhages near the disc, and many large conglomerate exudates about the regions of the macula and disc. Visual fields were normal, vision 20/30 in each eye without glasses. The vision improved to normal but a slight pigmentary deposit remained about the perimacular region.

Treatment consisted of the adminstration of streptomycin, penicillin, and corticosteroid. There was no sign that treatment had any favorable effect. (1 retinal color plate, 4 references) Paul W. Miles.

Delogu, A. and Cuccagna, F. **The action of light stimuli on the luminosity sense and visual acuity in retinitis pigmentosa and myopia.** Arch. di ottal. **63**:151-162, March-April, 1959.

The authors considered the possibility of therapeutic effect of bright light in five cases of retinitis pigmentosa and in 14 of myopia. The subjects looked into the Goldman-Weekers adaptometer with 2000 lux for 15 minutes daily for from one to three months. There was no sign of benefit. (1 table, 2 figures, 20 references) Paul W. Miles.

Gat, L. and Dayka, A. **Allergic papilloretinitis induced by the Mantoux test in patients with pulmonary or ocular tuberculosis.** Ophthalmologica 137:353-364, June, 1959.

The authors previously observed and described an allergic papilloretinitis as a focal part of a Mantoux reaction in patients with chronic ocular inflammatory diseases. (Ophthalmologica 117:43, 1949). About 25 per cent of the patients presented papilloretinitis (APR) as part of their disease prior to the Mantoux test, but showed a decided aggravation of the papillitis or the retinitis 24 to 72 hours after the test. The focal reaction subsided within two or three weeks without causing any permanent damage. The present study concerns itself with Mantoux-induced APR in 142 cases classified and treated as ocular tuberculosis on clinical evidence, and in 85 patients with pulmonary or renal tuberculosis. In both groups the incidence of pre-Mantoux APR was about 25 per cent. A positive APR response to the test was observed in about 40 per cent of the patients in both groups, that is, in the patients with presumptive evidence of ocular tuberculosis as well as in those with established pulmonary tuberculosis. The author considers this positive response as evidence for a tuberculous infection in a certain, hyperergic immunologic state. The results of antituberculous therapy were particularly favorable in the APR-positive cases of chronic inflammatory ocular disease. (4 tables, 35 references) Peter C. Kronfeld.

Sbordone, G. and D'Esposito, M. **Clinical studies on the localization of retinal lacerations in idiopathic detachment.** Arch. di ottal. 63:85-104, March-April, 1959.

The various methods of localization of the retinal tears and vitreous changes in retinal detachment are discussed. The problem of detachment in a cataractous eye is emphasized. One may locate the tear by the history of the location of the initial photopsia, tests of visual field, indirect ophthalmoscopy with a bright light and maximal dilatation of the pupil. The slitlamp with the Goldman prism and the Hruby lens is also helpful. Digital pressure at the ora is used. Intravenous fluorescein may help by coloring the detached area. Treatment is not discussed except in regard to the Strampelli instrument which coagulates the retina under direct ophthalmoscopy. (30 references)

Paul W. Miles.

Schappert-Kimmijser, J., Henkes, H. E. and Van den Bosch, J. **Congenital amaurosis (Leber).** Ophthalmologica 137: 420-422, June, 1959.

A systematic search has been made among the blind population of the Netherlands for cases of Leber's congenital blindness or dysgenesis neuroepithelialis retinae (Waardenburg) characterized by 1. blindness or very poor central vision, 2. no or minimal fundus changes, 3. absent or nearly absent electroretinogram, and 4. recessive hereditary occurrence. These principal symptoms are associated in some of the cases with keratoconus, cataract and nystagmus. This form of congenital blindness makes up about 18 per cent of all blind children and about 3.8 per cent of all blind adults in the Netherlands.

Peter C. Kronfeld.

NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 10th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. Marvin McTyeire Cullom, Nashville, Tennessee, died June 29, 1959, aged 90 years.

ANNOUNCEMENTS

NEW YORK UNIVERSITY COURSES

New York University Post-Graduate Medical School, Department of Ophthalmology, New York, offers the following courses:

Ophthalmic Plastic Surgery, a part-time course, 2:00 to 5:00 P.M., February 29 through March 4, 1960, under the direction of Dr. Sidney A. Fox. This covers the essentials of ophthalmic plastic surgery for the practicing ophthalmologist. Tuition $90.00.

Motor Anomalies of the Eye, a full-time course given in two parts, under the direction of Dr. Harold W. Brown. Part I is of six days' duration, March 7 through 12, 1960. Tuition $115.00. Part II is of five days' duration, March 14 through 18, 1960. Tuition $100.000. Please note change of dates for these courses.

Ocular Expressions of Systemic Disease, a part-time course, 2:00-5:00 P.M. March 21 through 25, 1960, under the direction of Dr. Isadore Givner. Tuition $60.00.

Surgery of the Eye, a full-time course, March 28 through April 2, 1960, under the direction of Dr. Rudolf Aebli. This includes lectures and practical work on the cadaver. Tuition $140.00.

For further information write to: The Dean, Post-Graduate Medical School, 550 First Avenue, New York 16, New York.

LOS ANGELES STUDY CLUB

The Research Study Club of Los Angeles announces its 29th annual midwinter convention in ophthalmology and otolaryngology January 18 through 22, 1960. Registration will be January 17th at the Ambassador Hotel, Los Angeles. Guest speakers for ophthalmology will be:

James H. Allen, M.D., New Orleans; Harvey E. Thorpe, M.D., Pittsburgh; and Carl D. F. Jensen, M.D., Seattle. Instruction courses will be under the direction of A. Ray Irvine, Jr., M.D., and Bradley R. Straatsma, M.D., Los Angeles; William Turnbull, M.D., Montreal; and Meyer Wiener, M.D., Coronado, California.

Special lectures will be given by H. Russell Fisher, M.D., Max K. Pierce, M.D., and Benjamin Simkin, M.D., Los Angeles. The special course on cardiac resuscitation by William P. Mikkelsen, M.D., will be repeated this year. The registration fee for the course is $110.00. For further information address Norman Jesberg, M.D., 500 South Lucas Avenue, Los Angeles 17, California.

INSTITUTO BARRAQUER COURSE

The second part of the course for ophthalmic training opened at the Instituto Barraquer, Barcelona, Spain, in October and will continue to July, 1960. Clinical sessions are held each Mondey, Wednesday and Friday and surgical sessions on Tuesday, Thursday and Saturday.

UNIVERSITY OF MICHIGAN CONFERENCE

The annual ophthalmology conference at The University of Michigan Medical Center will be held April 25, 26, and 27, 1960, under the direction of Dr. F. Bruce Fralick, chairman of the Department of Ophthalmology.

Applications may be addressed to the Department of Post-graduate Medicine, University Hospital, Ann Arbor, Michigan.

EMPLOYMENT REGISTRY FOR SCIENTISTS

In order to facilitate the growth of academic ophthalmology and otolaryngology in both clinical and basic science areas in the various medical schools and associated hospitals and institutions across the country, an Employment Registry for Scientists has been established by the American Academy of Ophthalmology and Otolaryngology. The registry will serve to aid in the placement of candidates completing training who desire academic and investigative positions and it will also facilitate the replacement of those already in such positions who desire, for one reason or another, to take a different position. The registry will be of great value to the candidates looking for positions as well as to institutions seeking to fill positions.

The following procedures will be established:

1. Institutions interested in filling a position will be asked to complete a one page "position available" form providing the registry with a description of the position and a minimum general requirement which must be met by a candidate. This form will be signed by the individual authorized to sign for the institution and duplicated upon receipt at the registry for subsequent distribution to condidates.

2. Individuals wishing to obtain academic or investigative appointments will be asked to complete a one page "candidate available" form outlining his general qualifications, that is, training and experience, and describing in general terms the type of

position sought. This form will also be duplicated upon receipt for distribution to institutions.

3. As soon as a notice of a vacancy is received the files, arranged on a position type basis, will be searched for candidates who desire such a position. The institution concerned will be sent a copy of the form of each candidate so found; this can probably be done by return mail. Periodic repeat searches will be performed, for example, monthly, until notification that the position has been filled.

4. As soon as a candidate form is received the files will be searched for available positions conforming to the type of position desired and copies of each institutional vacancy sent to the candidate.

5. As soon as each position is filled listings will be altered accordingly. The only condition imposed on candidates or institutions for this service will be an agreement printed above the signature on each form that the institution will advise the registry immediately upon filling the position and the candidate will do likewise upon accepting a position. Thus, the operation of the central placement registry will be practically completely mechanical and impersonal.

Since the operation of such a Central Registry will be of considerable service to ophthalmology and otolaryngology scientists, it will be devoid, because of the procedure outlined above, of bias and it will be operated by the academy without fee or obligation.

Washington Hospital Center

The Department of Ophthalmology, Washington Hospital Center, opened a series of lectures on November 7th which will continue through May 28th. Glaucoma was discussed at the November and December sessions. The schedule for the first two months of 1960 includes:

January 9th, 16th, 23rd, 30th and February 6th—the lens. Speakers for this series of lectures will be Dr. John H. Dunnington, Dr. Ben S. Fine, Dr. Lorenz E. Zimmerman, Dr. Robert E. duPrey, Dr. Bernard J. Gurwin, Dr. Everett C. Caldemeyer, Dr. James B. Bain, Dr. Benjamin Rones, Dr. J. Spencer Dryden, Dr. Dan G. Albert and Dr. Frank D. Costenbader.

"Lids" will be discussed on February 13th and 20th by Drs. Everett C. Caldemeyer, Sterling Bockoven, Walter J. Romejko, Thomas J. Schnebly, John W. McTigue and M. Noel Stow. On February 27th, Drs. William B. Glew, Joachim A. Kluger and G. Victor Simpson will speak on the "Lacrimal system."

All lectures are given in the Hospital Center auditorium beginning at 8:30 A.M. and terminating at 11:15 A.M. All physicians are invited to attend the course or individual periods. There is no fee for attendance. This series of lectures is partly financed by a grant from the Guild of Prescription Opticians of Metropolitan Washington. Further information may be obtained from the Department of Ophthalmology, Washington Hospital Center, 110 Irving Street, N.W., Washington 10, D.C.

Florida program

The ophthalmology program for the Florida midwinter seminar of ophthalmology and otolaryngology to be presented in co-operation with the College of Medicine of the University of Florida and the University of Miami School of Medicine at the Americana Hotel, Miami Beach, Florida, January 24 to 30, 1960, follows:

On Monday, January 25th, "Tonography in diagnosis and therapy of glaucoma," Dr. Bernard Becker, Saint Louis; "Vitreous syndromes," Dr. Joseph A. C. Wadsworth, New York; "Ophthalmologic errors that turn up in the pathology laboratory," Dr. David G. Cogan, Boston; "Gonioscopy," Dr. Robert N. Shaffer, San Francisco; "Bilateral sudden blindness," Dr. Frank B. Walsh, Baltimore.

On Tuesday, January 26th, "Ocular muscles and systemic diseases," Dr. Walsh; "Congenital glaucomas," Dr. Shaffer; "Tumors of the lid margins and their treatment," Dr. Wadsworth; "Use of the newer secretory inhibitors in glaucoma," Dr. Becker; "What examination of the eye tells us about systemic disease," Dr. Cogan.

On Wednesday, January 27th, "Secondary glaucoma," Dr. Shaffer; "What examination of the eye tells us about systemic disease," Dr. Cogan; "Selected case reports," Dr. Walsh; "Differential diagnosis of macular lesions," Dr. Joseph A. C. Wadsworth; "Use of the new miotics in glaucoma," Dr. Becker.

Minnesota course

The University of Minnesota announces a continuation course in ophthalmology for specialists which will be held at the Center for Continuation Study on the University campus from January 11 to 13, 1960. The diagnosis and treatment of strabismus will be featured in this year's program. Guest speakers will be Drs. Goodwin M. Breinin, professor and head, Department of Ophthalmology, New York University College of Medicine, New York; Edmond L. Cooper, instructor, Department of Ophthalmology, Wayne State University College of Medicine, Detroit; and Gunter K. von Noorden, instructor, Department of Ophthalmology, State University of Iowa College of Medicine, Iowa City, Iowa. The course will be presented under the direction of Dr. John E. Harris, professor and head, Department of Ophthalmology. The remainder of the faculty will include members of the faculties of the University of Minnesota Medical School and the Mayo Foundation. Lodging and meal accommodations are available at the Center for Continuation Study.

Miscellaneous

Meeting for school nurses

A total of 96 school nurses attended the meeting for school nurses of Long Island sponsored by the Long Island Ophthalmological Society. The program included:

"Introductory remarks," Dr. Arthur E. Merz; "The role of the ophthalmologist in the school health program," Dr. Eugene T. Buckley; "Visual

screening programs," Dr. Gerald M. Branower; "The ophthalmologist's viewpoint of reading difficulties," Dr. William L. Donnelly; "School lighting and vision," Dr. Jesse J. Michaelson; "The treatment of crossed eyes," Dr. Frank M. Green; "Aspects of the visually handicapped child," Dr. John R. Roche; "Educational aspects of the conservation of good vision," Dr. Anthony A. Scimeca.

Centennial of School

The centennial of one of the oldest and most progressive schools for blind and semisighted children, St. Henry's Institute at Grave, Holland, was celebrated October 24, 1959. A 322-page volume, entitled *The Visually Handicapped,* containing 32 papers by Dutch, French, German and American authorities, was published for this occasion.

Societies

Long Island Meeting

Dr. Algernon B. Reese spoke before the Long Island Ophthalmological Society at the November meeting. Dr. Reese's address, "Seeing eye to eye with the Russians," was a report on his recent trip to the U.S.S.R.

Association for Research

The Midwinter National Meeting of the Association for Research in Ophthalmology was held at the Medical College of Georgia, Augusta, Georgia, December 3rd, 4th, and 5th. The program included: "The pathology of early retrolental fibroplasia," Julian F. Chisholm, Boston; "Histopathology of the trabecular meshwork in glaucoma," J. Reimer Wolter, Ann Arbor; "The effect of hypothermia on aqueous humor dynamics: I. Intraocular pressure and outflow facility of the rabbit eye." Bernard Becker, Irvin P. Pollack, and Marguerite Constant, Saint Louis; "The effect of hypothermia on aqueous humor dynamics: II. Ultrastructural changes in the rabbit ciliary epithelium," Åke Holmberg and Bernard Becker, Saint Louis; "The inhibition of corneal vascularization by triethylene thiophosphoramide," Maurice E. Langham, Baltimore; "Various laboratory aspects associated with alpha chymotrypsin," Charles W. Damaskus, Kankakee, Illinois; "Vergence and accommodation; IV. Effect of illumination on the AC/A ratio," Mathew Alpern, and B. F. Larson, Ann Arbor; "Frequency desynchronization of physiologic rhythms after blinding," Franz Halberg, Minneapolis; "Binocular summation of subliminal repetitive visual stimulation," Robert H. Peckham and William M. Hart, Bethesda; "Flourescein in applanation tonometry," Robert A. Moses, Saint Louis.

On Thursday afternoon, December 4th, there was a workshop on "Sources of research support and suggestions for making application," with James H. Allen, New Orleans, serving as chairman.

The Southeastern Section meeting was held on Saturday morning, December 5th. The program included: "Slow oscillatory phenomena of the human corneoretinal potential," Hansjoerg Kolder and Gerhard A. Brecher, Atlanta; "Morphologic and histochemical changes occurring in cat corneas during long-term glycerol freezing," Frederick W. Stocker, Durham; "Congenital toxoplasmosis: VI. Estimated versus observed incidence of the disease," John R. Fair, Augusta; "Experiences in developing instrument systems for corneal surgery," Richard G. Weaver, Winston-Salem.

Montreal Society

The first quarterly meeting of the Montreal Ophthalmological Society for the year 1959-60, with Dr. Roland Cloutier presiding, was held recently at the Royal Victoria Hospital. The guest speaker was Dr. J. Clement McCulloch of Toronto, Ontario, whose subject was "The mechanical complications of surgical penetration in the eye." Other papers presented were: "Viscosity studies on aspirated human vitreous," Dr. G. K. Edwards and Dr. J. C. Locke; "The visual cerebral cortex," Dr. B. D. Burns; "Diathermy of intraocular cyst," Dr. S. B. Murphy.

Personals

Wright Lecture

Dr. Frank B. Walsh, professor of ophthalmology, The Johns Hopkins University, Baltimore, delivered the second University of Toronto Walter W. Wright Lecture in Ophthalmology at the Academy of Medicine, Toronto, on October 23, 1959.

Dr. Walsh spoke on "Trauma to the skull and certain ocular findings."

The Walter W. Wright Lectureship in Ophthalmology was established a year ago in honor of Dr. Walter W. Wright, professor emeritus of ophtholmology, University of Toronto.

Honored by Navy Department

Herman D. Scarney, M.D., chief of staff of William Beaumont Hospital, Royal Oak, Michigan, was placed on the retired list of the United States Navy Reserve with the rank of Rear Admiral as of September 1, 1959.

Admiral Scarney completed over 30 years of service in the United States Navy and was active in the aviation arm of the Navy during World War II. He spent five and one-half years on active duty serving as senior medical officer and chief flight surgeon at the Naval Air Station, Grosse Ile, Michigan; Naval Air Station, Dallas, Texas, and senior medical officer, and chief flight surgeon on the staff of the Commanding General, U. S. Marine Air Station, Cherry Point, North Carolina. He served as senior medical officer and chief flight surgeon aboard the aircraft carrier U.S.S. Cabot operating with the Third and Fifth Fleets under the commands of Admiral William Halsey and Admiral Spruance.

Receives Award

The Society of Military Ophthalmologists awarded the certificate of honorary membership to A. Edward Maumenee, M.D., at its annual meeting in Chicago. This award is made periodically to an outstanding ophthalmologist who has contributed to the advance of military ophthalmology.

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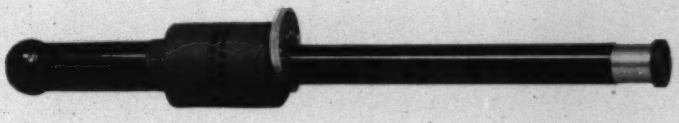

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* Am. J. Ophth. 36, 1130, 1953.

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